

Introducing ICT into the Irish School System: An exploratory study of the impact of innovative technology models on schools participating in the Schools IT 2000 SIP Initiative.

Volume 1 (of 3)

by

Miriam Judge B.A. (hons.), H.Dip.Ed., MSc.

**Dublin City University
School of Computer Applications**

Supervisor: Dr. Peter McKenna

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Declaration

I hereby certify that the material, which I now submit for assessment on the programme of study leading to the award of Doctor of Philosophy is entirely my own work and has not been taken from the work of others save and to the extent that such work has been cited and acknowledged within the text of my work.

Signed: Miriam Sudge
Candidate

ID No: 97970573

Date: 17 December 2002

Abstract

The purpose of this doctoral dissertation is to explore the key learning experiences of schools involved in introducing innovative technology models to support the introduction of ICT (information and communications technology) into the Irish school system.

The background to the research is the 'Schools IT 2000' initiative that was launched by the Irish Department of Education and Science (DES) in 1998. The Schools Integration Project (SIP), administered by the National Centre for Technology in Education (NCTE), was a key strand of this initiative. Its remit was to explore creative ways in which ICT could be successfully integrated into the existing school system at primary and post-primary levels. Two SIP projects, one known as the "Wired for Learning" project and the other as the "Thin Client Server Solution" project are the focus of this research.

The Wired for Learning project is a multi-site project involving five schools in Dublin and Cork, comprising both primary and post-primary schools, piloting the use of a collaboration and communications technology system, designed and supported by IBM, for the entire school community. The Thin Client Server Solution project is a single site project with a whole school development focus, piloting the suitability of an ICT infrastructure for primary schools, based on thin client network technology using Citrix metaframe.

Using a collective case study methodology, the researcher has conducted a detailed qualitative investigation of the process involved in implementing these technology projects into schools. The study's findings bring the issues of technology, teachers, change and the school and teaching culture into sharp focus, as the research unveils the 'emic' issues that emerged as these two innovative technology models were introduced and implemented. It provides a unique insight into the role of sociological and psychological factors in the processes of innovation

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Dedication

For my wonderful mother, Patty, who has always been the wind beneath my wings,
and for my sisters, Sandra, Sharon, Denise, Janice and my brother Des, for putting up
with me for more years than I or they care to remember. Also for my father, Dessie,
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Abbreviations

ASP	Application Services Provider
CAD/CAM	Computer Aided Design/Computer Aided Manufacturing
CAL/CAI	Computer Aided Learning/Computer Aided Instruction
CMC	Computer Mediated Communications
CSCL	Computer Supported Collaborative Learning
CSCW	Computer Supported Co-operative Work
DCU	Dublin City University
DES	Department of Education and Science
DLK	Dundalk Learning Network
GIS	Geographic Information System
GUI	Graphical User Interface
HSCL	Home School Liaison
ICA	Independent Computing Architecture
ICDU	In Career Development Unit
ICT	Information and Communications Technology
INTO	Irish National Teachers Organisation
LAN	Local Area Network
MBTF	Meantime between Failure rate
NC	Network Computer
NCA	Network Computing Architecture
NCTE	National Centre for Technology in Education
Obnotes	Observation Notes
RE	Reinventing Education
RTT	Resource Teacher for Travellers
SIP	Schools Integration Project
SMIL	Simultaneous Multimedia Integration Language
TCO	Total Cost of Ownership
TLTP	Teaching and Learning Technology Programme
TSI	Teaching Skills Initiative
WAN	Wide Area Network
WBT	Windows Based Terminal
WFL	Wired for Learning

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Chapter One

The Context of the Study

"As the history of artificial intelligence shows, computer science has long found social issues particularly hard to deal with (as indeed have social scientists). Social issues are remarkably hard. "It isn't that these issues aren't interesting", Robert Wilensky, a professor of computer science of the University of California, Berkley, put it succinctly, "it's just that these problems, like so many social/psychological issues, are so hard that one had to hope they weren't on the critical path."

"The Social Life of Information", Brown & Duguid, 2002

Introduction

Amidst the techno babble that dominated much of the 1990's and the early months of the new millennium, the first publication of the 'Social Life of Information,' in the year 2000, was a timely, and perhaps sobering reminder, that technology occurs in a social context that is often overlooked by techno enthusiasts. In this illuminating and thought provoking book, Brown and Duguid (2000) argue that innovation is not just about technology, it is also about human beings, and that any technology which does not accommodate the social context within which human beings operate is doomed to failure.

The significance of Brown and Duguid's thesis for this research is that it implies that the study of any technological innovation and its implementation, must look beyond the technology itself to encompass a more holistic understanding of people and the social context which mediates how, when and if an innovation gets adopted.

Nowhere is the need for this approach more evident than in the study of educational technology where technology has persistently failed to make significant inroads into the modus operandi of schools and teachers. As Starr (1996) points out "the history of education in the twentieth century is littered with mistaken forecasts of technological revolutions in education" (p. 51). From the invention of motion

pictures and radio to television and computers, from the predictions of the inventor Thomas Eddison, (1913)... "The motion picture is destined to revolutionize our educational system and....in a few years it will supplant the use of textbooks", to those of the computer scientist, Simon Papert (1984), ... "there won't be schools of the future....I think the computer will blow up the school," (cited in Cuban,1986) successive rounds of new technologies have failed to live up to their promoter's expectations and a distinct pattern has emerged. Cuban (1986) called this pattern the "exhilaration/scientific/credibility/ disappointment/ blame" (p.5) cycle in which each new innovation has been greeted with initial enthusiasm, followed by disappointments, to be eventually relegated to the margins of education.

While in the past issues such as teacher resistance, inadequate resources, and computing complexity have been cited as the causes of this failure cycle, more recent thinking has highlighted the need to adopt a more holistic approach (Sandholtz et al., 1997; Means, 1994; Knufffer, 1993; Cuban, 1993b;1986) to our understanding of the role of technology within the larger context of the culture of the school and the interaction between technology, the teacher and the learning environment. As Knuffer (1993) reminds us, proponents of instructional computing have traditionally given "short thrift to the role of teachers" (p. 173), focussing their attention primarily on student benefits, while paying scant attention to the teacher's role in the acceptance, implementation and outcome of educational computing, despite compelling evidence of the centrality of teachers in the implementation of educational innovation.

Such shortcomings were also acknowledged in a report on 'Teachers and Technology' (1995), produced by the American Office of Technology (OTA) which pointed out that "a gulf exists between the ambitions of technology experts, and software developers and the practice of teachers in the classrooms" (p.126). Furthermore the report also commented that "despite the central role of the teacher in the educational applications of technology, there has been relatively little research on how and why teachers use technology.... little attention has been given to its impact on teachers" (p. 51). To redress this situation The OTA called for a change of focus in the research agenda for educational technology so that research attention is directed at the 'chief agents of change', the teachers, and how they view the

technology and the learner. It is this spirit of enquiry which informed the research agenda for this dissertation.

Background

The purpose of this dissertation is to explore the key learning experiences of schools and teachers involved in introducing innovative technology models to support the introduction of ICT (information and communications technology) in the Irish school system. The background to the research is the 'Schools IT 2000' Initiative which was launched by the Irish Department of Education and Science (DES) in December 1997 for a three year period (1997 –2000). The significance of 'Schools IT 2000' from the perspective of the Irish education system is that it represents the first major attempt at a national level to computerise the nation's schools across the entire first and second level sectors. In terms of educational technology it can be said that Ireland was a late developer when compared to the UK, the USA and many of its European neighbours. The policy document supporting 'Schools IT 2000' acknowledged as much in its introduction when it said:

"Ireland lags significantly behind its European partners in the integration of information and communication technologies (ICT's) into first and second level education. The need to integrate technology into teaching and learning right across the curriculum is a major national challenge, which must be met in the interests of Ireland's future economic wellbeing."

(www.irlgov.ie/educ/it2000/summary.htm, p.1)

'Schools IT 2000' set out a clear policy framework for the integration of ICT's across the school system and €51 million was set aside for the three year programme. A dedicated agency, known as the National Centre for Technology in Education (NCTE), located at Dublin City University, was established in early 1998 to implement the Government's IT strategy. The NCTE was charged with the task of initiating and supporting four major strands, encompassing infrastructure, teacher skills, pilot projects, and support and resources that the framework document identified as critical to the success of 'Schools IT 2000'. National coordinators and

support staff were appointed for each of these areas. One of the strands, known as the Schools Integration Project (SIP) provides the context for this research.

Schools Integration Project (SIP)

A major focus of Schools IT 2000 was to explore creative ways in which ICT could be successfully integrated into the existing education system at primary and post-primary levels. The Schools Integration Project (SIP) had a key role to play in this development as its remit was to establish a series of pilot projects aimed at developing good practice and experimenting with innovation in ICT. To achieve this the SIP national co-ordinator contacted all schools in the country to see if they had an ICT idea or activity that they wished to develop and try out. Schools were invited to discuss their ideas with the NCTE, and in consultation the ideas were developed and adapted (Morrissey, 1999). In total there were nearly 600 responses and as there were strong similarities between ideas, schools were encouraged to work with each other to further refine and expand their proposals. Partnership developments with industry, the community, education centres and third level institutions were also encouraged.

In all 48 projects, involving 228 schools were funded by SIP to the tune of €4.5 million, when the successful projects were announced in April 1998. There were 28 sponsors from the public and commercial sector and 58 project partners from third level institutions, local communities and other agencies. In the context of 'Schools IT 2000' which was effectively a top-down initiative, SIP was a particularly interesting development as it was fundamentally a bottom up initiative in which schools were encouraged to propose their own innovative projects in the use of ICT. Participation in SIP had many benefits as successful SIP projects received additional resources at school level in key areas such as infrastructure, resources and staffing, and specialised training courses.

Selection of SIP Projects as the basis for Research

As a researcher I became interested in SIP as a result of my appointment as a PhD Research Fellow for the Irish Tech Corps, an initiative which preceded and laid the

foundations for the Schools IT 2000. The Irish Tech Corps was a voluntary body comprising two key academics from the School of Computer Applications at Dublin City University (DCU) and IT industry representatives, keen to advance the use of ICT in Irish schools, in the absence of any government leadership in that arena. The aim of the Irish Tech Corps project was to recycle older machines from industry into schools in order to encourage schools to begin using ICT and to provide technical and pedagogic support for schools. When I joined the Tech Corps as a PhD Research Fellow in October 1997, the project had been in operation for almost a year. At that point 20 schools had been selected for inclusion in the Tech Corps project and plans were in place to expand and cap that number at 50 schools. I was appointed as a Research Fellow on the understanding that I would conduct research, as yet undefined, on the use of ICT in schools using the Tech Corps schools as my research base.

At this stage it is probably clear from what I have already written in the previous sections, that events at the national level, which were highly influenced by the Irish Tech Corps project, soon overtook this project. With the establishment of the NCTE on the DCU campus, it became untenable to maintain the Tech Corps project as a separate entity, not least because it would have involved unnecessary duplication. Consequently by June 1998, seven months after I had been appointed as a Research Fellow, plans were put in place to officially wind down the Tech Corps project. Shortly thereafter my supervisor resigned to take up a more senior academic appointment elsewhere. As there were no other academic members of staff in the School of Computer Applications with an expertise in ICT in Education it was decided that my supervision should switch to the School of Education Studies, also located on campus, where there was an expertise in this area. The necessary arrangements were made and at the commencement of the academic year, 1998/1999, a new supervisor from the School of Education was appointed as my PhD research supervisor.

With the issue of supervision sorted, I now needed to red-direct my attention to the question of research and securing a research base. It made sense to adjust my research stance to accommodate what was happening at the national level as a result of the 'Schools IT 2000' initiative. However as the NCTE was in the early days of

its start-up, I felt it would be advisable to hold off contacting them for a few months, until things settled down. Meantime I continued researching key literature in the area of ICT in education and prepared a couple of conference papers on Computer Mediated Communications, an area that I had developed an interest in during my first year as a Research Fellow. During this time I investigated the possibilities of using a pilot 'JAVA Literacy' project, due to commence in a number of schools in 1999 as the basis for my research. However for a variety of reasons I eventually ruled this out. I also kept a close eye on developments at the NCTE and having looked at the four major strands of the initiative I decided that the SIP strand was the area I was most interested in pursuing for research purposes. It was the area that most closely allied the original Tech Corps project.

In May 1999 I contacted the SIP national coordinator to set up a meeting to discuss the possibilities of undertaking research involving SIP. A meeting was arranged shortly thereafter and he was very open to the idea of my becoming involved with SIP as a researcher and using it as the basis for my PhD. He gave me a copy of the Directory of SIP project, containing one page outlines of each of the 48 projects. Having studied the directory in detail, I identified five projects that I thought had excellent research potential. I had a number of follow-up meetings with the SIP coordinator over the summer months to discuss these five projects further and in more depth. As a result by September 1999, just as schools returned from holidays, I had narrowed my research interests to three potential projects. The SIP national coordinator agreed to formally contact the schools involved in these projects on my behalf with a view to setting up an initial exploratory meeting for me to discuss research ideas with them. Consequently during October and November 1999 I met with key personnel from all three projects, and as a result of these meetings, I decided my research efforts would be best served by concentrating on two SIP projects. These projects were:

- (1) **The Wired for Learning project.** This is a multisite project involving 5 schools in two separate geographic locations, piloting the use of collaboration and communication technology for the entire school community. The first site comprises three schools in Dublin, one post-primary school, a senior primary

school and a junior primary school. The second site comprises two schools in Cork, involving a primary and post primary school.

The Wired for Learning project represents a good example of industry-education links, as it is sponsored by IBM, Ireland, who formed a partnership with the Department of Education and Science in 1998 to initiate and support this project. The backbone of the programme is a core of innovative technology solutions, developed by IBM on a software platform known as 'Wired for Learning'. The essence of the project is to develop the use of ICT's as an education and communications tool not just within the school, but within the entire community, in order to facilitate systemic change in the way schools are organised and operate.

- (2) **The Thin Client server solution project.** This is a single site project involving one primary school with a whole school development focus, piloting the suitability of an ICT infrastructure for primary schools based on thin client network technology using Citrix Metaframe. The benefits of this configuration are that low cost Thin-Client terminals as well as older PCs can be used to deliver a standard desktop across the school, thereby helping schools to reduce the total cost of ownership associated with traditional desktop environments. It also has the potential to reduce the administrative and housekeeping load associated with network management, thereby freeing the ICT teacher up for more classroom based and learner centred tasks.

I chose these two projects as the focus of my research for a number of reasons. Firstly I felt they were among the most innovative and ambitious of all the SIP projects and therefore in my opinion they offered a unique opportunity to research ICT models of best practice across a variety of school settings. Secondly because of their innovative nature, I believed that the outcome of these projects would have national significance in terms of future policy development for the continuing adoption of ICT's in schools. Thirdly they offered me a robust and stable research base for conducting an original piece of research on the process of introducing innovative ICT projects to a national network of schools for the first time. Finally the radically different nature of the two projects in terms of technology, structure

(multi-site versus single site), school socio-economic context and the ICT experience of the project leaders offered exciting potential for comparing and contrasting the experiences of research participants along several different yet interacting dimensions.

The Research Framework and Research Questions

As the title of this dissertation suggests, this work commenced as an 'exploratory' study and therefore the qualitative research paradigm, with its emphasis on naturalistic inquiry (Lincoln and Guba, 1985) and emergent design, was deemed the most appropriate framework within which to conduct the research. As the study involved a number of schools and two different projects, a collective case study methodology as defined by Stake (1995) was adopted. A set of six key research questions, which are presented in Chapter four and in *Appendix M3, Case Record, Volume 111*, were used to frame the study. These research questions were adapted from a proposed OECD international study on the relationship between ICT and school innovation. As some of the OECD questions were of particular relevance to this study, I decided to adapt them to establish a focus for my research.

Educational Technology and Change

Educational technology and change are intricately linked. Just as the introduction of new technology has brought about changes in society and in the workplace, the introduction of computers to schools also has change implications. When computers were first introduced into schools during the 1980's, policy decisions were highly influenced by the vocational/economic rationale as defined by Hawkrige (1991), and consequently there was an over-riding emphasis on 'learning about computers.' It was easy to identify the type of change being proposed and to confine the relationship between IT and change to one part of the school system, namely the curriculum. Apart from the teachers charged with teaching this new subject and the administrators who had to put the necessary plans in place to accommodate it, the majority of teachers were unaffected by this change.

As the pace of technological change in society at large gathered momentum and continued unabated throughout the 1990's, the role which IT was expected to play in education expanded significantly. The vocational rationale was soon superseded by the more encompassing social rationale in which the concept of digital literacy came to be seen as an essential life skill necessary for participation in both the workplace and in society (OECD 2001). It was believed that failure to acquire ICT skills, would create an underclass of the digitally dispossessed who would be unable to participate in any meaningful way in the democratic functioning of the new information society that was emerging. It was essential therefore that schools took the necessary steps to ensure that all children would become ICT literate. As a result the emphasis shifted from learning about computers to learning with computers. 'Learning with' came to be seen as one way of ensuring that all children would be able to navigate their way in a technologically mediated society , economy and culture.

The shift towards the social rationale was also accompanied by a growing awareness of the pedagogical rationale for the use of ICT in teaching and learning. As the computer became more sophisticated, and in accordance with Moore's Law, more powerful and more affordable, it underwent a 'personality change'. It came to be seen as a much more versatile pedagogical device and its instructional role shifted from that of a tool to teach with to a tool to think with (Jonassen, 1995). Consequently the concept of the computer as a 'cross-curricular' tool quickly became common currency in ICT educational discourse as the computer's capacity to increase the breadth and richness of learning was emphasised more and more. Enhanced multimedia capabilities and the development of computer mediated communications meant that the computer now had the potential to support 'constructivist' learning environments, thus freeing it and education from the shackles of 'behaviourism', with its emphasis on rote learning (drill and practice) and the teacher or machine as the source of knowledge (CAI/CAL).

Whilst the constructivist debate was largely confined to academic discourse, the concept of the computer as a 'cross curricular' tool, became a reality which most teachers in developed nations had to confront, as national policies supporting the computerisation of schools were formulated throughout the 1990's. This has had far

reaching implications for teachers and schools in ways that go beyond the obvious, as Knuffer (1993) points out:

"Admitting computers into the school does not equate with incorporating them into the curriculum or with their rational, planned use. Computer technology brings with it changing rôles for teachers that involve not only changes in their relationship with other teachers and administrators, but also changes in their relationship with the community, their approach to students, the curriculum, and specific lessons. Those changes affect the very structure of the educational institution". (p.177)

Knuffer (1993), makes two further important points about the relationship between computers, schools and change. Firstly she argues that the successful implementation of computer technology into education requires an understanding of the process of educational change and that this understanding must precede the actual implementation of the innovation itself. Secondly the teacher's role must be seen as central to any change because successful educational change depends on what teachers do and think (Sarason, 1982). Ultimately it is the teacher who must adopt computers and then adapt them to curriculum goals and classroom needs (Cuban, 1986; Fullan, 1991).

In a similar vein the external evaluation of the UK's Teaching and Learning Technology Programme (TLTP) undertaken by Coopers and Lybrand in 1996, identified the management of change as a key issue to be resolved if technology is to play a proper role in learning. Shortly thereafter the Dearing report (1997) argued that the successful use of technology would require a significant change in the role of teachers and advocated that all institutions should review the changing role of staff as a result of the introduction of ICT. Furthermore Dearing went on to say, "The successful exploitation of communications and information technology will require a re-think of institutional priorities and a change of institutional culture. The leadership given by senior management will be critical" (Dearing 1997, 13.15). Although both of these reports were targeted at the Higher Education sector, the points they make about the management of change, the role of leadership and the changes required of teachers and institutional culture to accommodate ICT, are just as relevant for the first and second level sectors.

Managing Change

Fullan (1995) provides a conceptual map of the four main strands involved in educational change. Managing the successful implementation of any innovation depends on the extent to which the complexity and inter related nature of each of these strands is understood.

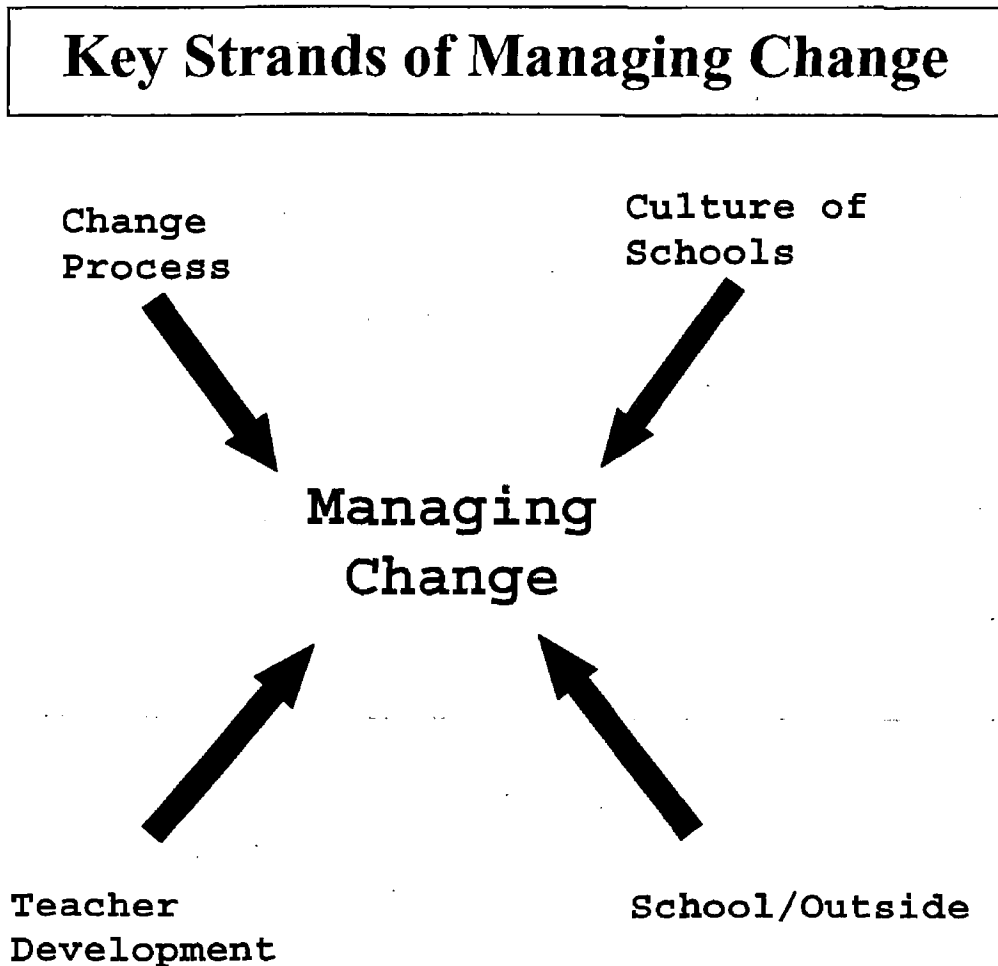


Figure 1: Source: Issues and Strategies in the Implementation of Educational Policy. P. 34

The Change Process

In his earlier writings Fullan (1982;1991), drawing on the work of various researchers describes the change process as consisting of four broad phases which he defined as Initiation, Implementation, Continuation and Outcomes. He maintains that there is considerable interaction between each of these stages with events from each stage influencing the other.

The Initiation phase of an innovation is crucial and the best beginnings should combine what Fullan calls the three 'R's. These are

- Relevance
- Readiness
- Resources

Relevance combines the need for the innovation, the teacher's understanding of it (clarity) and its usefulness (practicality) to teachers and students. Readiness which encompasses both organisational and individual factors involves the school's capacity to 'initiate, develop or adopt a given innovation' and the extent to which it addresses the perceived needs of individuals. Resources concern the provisions of supports necessary for the innovation's implementation phase. Change efforts will have a better chance of success when the three R's are present from the outset.

The implementation and continuation of an innovation depend on a number of different factors and processes which have a direct bearing on successful outcomes. Fullan (1991) identified three categories made up of nine factors critical to the success of the implementation process as illustrated in the diagram overleaf. These categories are:

- The Characteristics of the innovation or change project
- Local Roles
- External Factors

During implementation the characteristics of change itself, and particularly its relevance, impact the endusers for the implemented change, most usually teachers. Teachers do not always see the need for an advocated change. If the innovation lacks clarity, or requires a lot of effort to implement because of its complexity or is perceived as impractical, it will encounter strong teacher resistance.

Key Factors Affecting Implementation

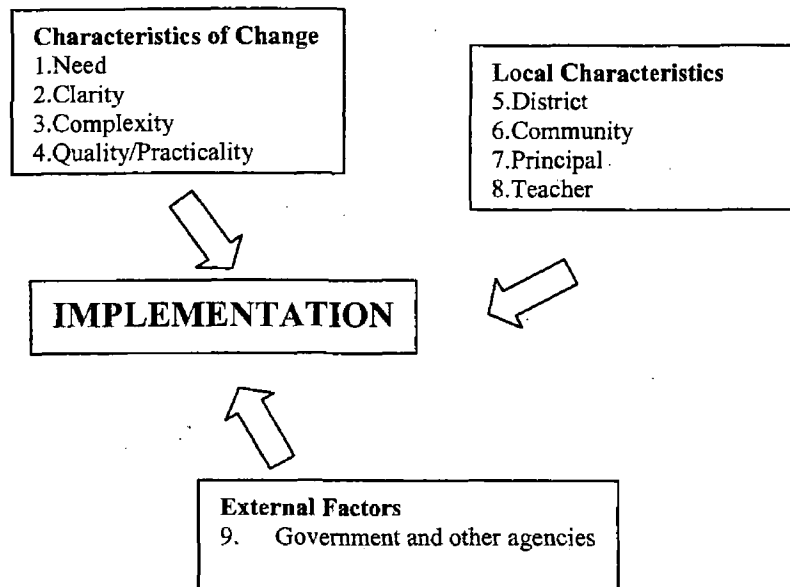


Figure 2: Source: *The New Meaning of Educational Change*. (p. 68)

Because the ‘fit’ between the innovation and the needs of a school may not become entirely clear until the implementation process is well underway, both local support and good leadership are essential ingredients for successful implementation. Innovations which are well supported both within the school by Principals and outside the school by the School District Board and the Community have a greater chance of success. The type of leadership given by both the school principal and the district superintendent is crucial. Principals in particular have a key role to play in motivating teachers, galvanising their support and helping teachers to see the significance of the innovation. This is a hugely complex task as the principal has to be capable of dealing with teachers’ concerns about the innovation, depth of

resistance to it and the cultural climate of the school which can impede or assist an innovation's progress.

Introducing an innovation like ICT into a school can place added demands on a principal's leadership skills as the thorough integration of ICT is likely to require changes in school timetables and structures, as well as having resource implications (OECD 2001). It is essential therefore that school leaders understand fully the issues surrounding the adoption of ICT, adopt a whole school approach to its implementation and develop a shared vision around the challenges and implications for all involved.

Teacher Development

A second critical strand in the management of change concerns the development of teachers. Various researchers and policy reports (Carter, 2000; Elmore & McLaughlin, 1998; Fullan 1993; OECD 2001; NCTAF, 1996) have advocated the need for a change in both the initial training of teachers and their continuing professional development. Both Fullan (1993) and Sarason (1996) see the problem as an enormous one by virtue of the fact that teaching as it is currently constituted is not a learning profession, in other words the teaching profession lacks a culture of continuous professional development compared to other professional occupations. While Sarason (1996) despairs of the future of teachers and schools on this basis, Fullan adopts a more pragmatic approach, believing that the problem can be addressed by re-structuring the traditional approach to teacher training where the seeds for lifelong learning can be planted. At the same time he sees a need for the re-culturing of schools whereby schools themselves become 'learning organisations' in which teacher professional development is actively encouraged and where a collaborative work culture replaces the isolationist culture traditionally associated with teaching. (Fullan 1993; OECD 2000). Such a culture would provide the conditions whereby teachers could work with and learn from each other on an ongoing basis. Teacher development and institutional development must go hand in hand. You can't have one without the other.

The need to develop a culture of lifelong learning among teachers is rooted in the development of the knowledge economy and the learning society. If teachers are to prepare students for a world in which lifelong learning is an essential skill they themselves must become lifelong learners (OECD 2001; Fullan 1998) and come to grips with the needs of the knowledge economy which are constantly changing. This means they will have to learn to change with the times and in accordance with new societal demands on schools. We cannot have a learning society without a learning profession of teachers (Fullan 1993, p.131).

The capacity to change at both an individual and organisational level has become an essential requirement of the post-industrial society in which new technologies have become the drivers of change. Understanding this change and how it is impacting teachers and schools and dealing with the consequences of that change needs to become part and parcel of teacher professional development. Teachers need to be empowered to deal with change and to be the instigators of change in their own professional lives rather than seeing themselves as the victims of change. It follows therefore that teacher professional development should help to prepare teachers to become change agents in their own right and to develop their capacity for leadership roles.

The large scale introduction of ICT in schools has exposed many of the problems associated with a profession ill-equipped for lifelong learning and underscores the pressing need for ongoing teacher professional development. ICT is often viewed as a 'catalyst for change' a type of 'trojan horse' (Papert, 1997; Hodas, 1996; Newman 1992; Kerr, 1991) through which fundamental educational change can be delivered. Teaching with a computer requires not only a degree of technical proficiency but also a decidedly different role for the teacher (Hannafin & Savenge, 1993). Some commentators (Broadfield 1998; Van den Akker et al., 1992, Somekh and Davies, 1991) argue that because the computer facilitates more student centered learning the teacher's role as the main source and supplier of knowledge diminishes. The teacher has to learn new technical and pedagogical skills. Because technology is constantly changing, there is a need for ongoing professional development in the use of ICT and a continuous updating of skills. (Harris 1999; CEO Forum 1999; Stevenson,

1996). This can be hard to inculcate in a profession unused to continuous professional development. As Goldstein (1997) notes:

"Initial and in-service professional training and technical support for IT-based work have not kept pace with the rapid changes in technology. This situation is exacerbated where IT co-ordinators have virtually no time during the school day to help teachers to evaluate and develop their work in IT". (p.6)

Learning to come to terms with a different role for the teacher is even more problematic as it is ultimately linked to the problem of change and how well people have been managed to deal with change. Unfortunately this is an area as we have already seen where teachers have received little professional development and guidance.

It is not surprising therefore that many teachers initially resisted the introduction of computers into schools and while much of that initial resistance has now been overcome as a result of teacher training programmes in ICT, teachers still appear to be resisting the new role itself. In the UK for example, where Government initiatives have supported the use of technology in schools since the 1980's and where schools have been traditionally quite well resourced by comparison with other European countries (Mediawise Communications US Inc, 1997), research evidence suggests that the impact on classroom practice has been relatively limited (GB.DfEE; 1997, Chalkley and Nicholas, 1997). As Bell (1997) states:

"Although some teachers have adopted the new technologies and changed the way they work, no one can claim this approach has permeated the whole profession." (p. 6)

It seems that when teachers use computers they attempt to incorporate ICT into their existing classroom practices and their established pedagogy rather than experiment with new approaches (Veen 1993). Similar findings are reported by other international research studies (McFalane and de Ricjcke; 1999, Pelgrum & Plomp 1993; Collis 1993; ESRC 1990). Summarising the findings of three major

international research studies (IEA CompEd, 1993; ITEC, 1993; YCCI 1994) Collis et al.(1996) have this to say:

"Two main observations seem to emerge. The first is the central importance of the teacher, not the technology, in whatever happens with computer technology in schools. The second is that the role of the teacher, and the educational paradigm underlying that role, must change in order for the potential of information technology as a problem-solving tool and as a stimulus for fundamental change to occur." (p. 106)

Probably one of the great ironies of the computer is that is "unusually polyvalent in that it can both support and subvert the symbolic, organisational and normative dimensions of school practice" (Hodas 1996, p. 210). This means it can be used to support and reinforce traditional teaching pedagogic practices or to transform them. Activities such as drill and practice and organisational arrangements such as the installation of computer labs minimise the transformative potential of educational computing and ensure that computer use takes place at the margins of the educational process. On the other hand the use of open learning tools and problem solving software and the installation of computers in classrooms opens up possibilities for richer and more challenging learning environments to emerge. However for this to occur teachers' beliefs and conceptions of learning need to change. This is a hugely complex task as these beliefs have been shaped by the 'crucible' of classroom experience, societal expectations of schooling and the culture of teaching itself. (Cuban1993a; 1993b;1988; 1986; Sarason 1996; Tobin and Dawson, 1992).

The School Culture

The founder of the European Community, Jean Monnet, once declared: "If I were again facing the challenge to integrate Europe I would probably start with culture". Culture is the context in which things happen in society, institutions and organisations. The culture of the school is a key strand in the management of change because of the way it interacts with the change process (Fullan 1995). Culture is not easily defined because it is largely implicit. The concept of culture as Schein (1992) notes is intimately intertwined with organisational norms and values which influence

and shape how groups and individuals think and behave and through which systems of shared meanings evolve. Although difficult to decipher, organisational culture usually presents itself as “the way we do things around here”(Deal & Kennedy, 1983). Fullan and Hargreaves (1991) have identified four types of school cultures:

- Fragmented Individualism
- Balkanization
- Contrived Collegiality
- Collaborative

The predominant school culture tends to be individualistic with teachers working in isolation affording little opportunity for teachers to work together or to exchange ideas on a sustained basis. “Teaching more than many other occupations, is practised in isolation, an isolation that is at times crushing in its separateness” (Maeroff, 1988, p. 3). It can be very difficult to introduce and sustain reform in this type of culture . The same is true of balkanized cultures that are characterised by teacher cliques and intensive subgroups. This usually occurs in large schools where it is easy for subcultures to develop. In these cultures group or professional loyalty tend to be the norm and there is little identity with the school as a whole. Consequently there is little possibility for whole school reform because subcultures inhibit school-wide initiatives. In contrived collegiality cultures teachers may be ostensibly participating in site based structures as a result of management interventions. However unless these changes in formal structures (restructuring) become internalised by teachers themselves, it will not translate into substantial changes in professional and pedagogical practices (reculturing). Collaborative cultures exude a strong sense of collegiality in which teachers work together and support each other in their daily work. The ethos of professional collegiality that permeates collaborative work environments makes a big difference to the quality of learning, for both teachers and students. Research over the last fifteen years has clearly demonstrated that schools and districts with strong professional learning communities enable teachers to respond more successfully to the needs of students and to sustain positive change (Moffett, 2000). Changing the professional culture from fragmented individualism to collaboration is the key to sustainable reform.

Sarason (1982) warns that school reform programs are destined to fail if school and district leaders don't examine whether the culture of the school and of the district support the proposed reform. Inevitably when we try to introduce information technology into education one of the first things we run into is culture (Murray-Lasso, 1996). Cuban (1986; 1993a) argues that one of the reasons why the computer has failed to affect schools in the way that its proponents hoped is due to dominant cultural beliefs about teaching and learning which are shared by teachers and society at large. These beliefs and norms are further reinforced by the organisational structure of schools.

"Cultural beliefs such as that teaching is telling, learning is listening, knowledge is subject matter taught by teachers and books, and the teacher-student relationship is crucial to any learning dominate popular and practitioner thinking. Most taxpayers expect schools to reflect those centuries-old beliefs.....A century old form of school organization shapes classroom organisation with its self-contained classrooms separating teachers from one another, a curriculum divided into segments of knowledge and skills distributed grade by grade to students, and a schedule that brings students and teachers to work together for brief periods of time. These structures profoundly influence how teachers teach.....and are especially difficult to alter after a century of popular and practitioner acceptance." (p. 198)

This suggests that teachers behave in accordance with the norms and expectations of society at large which is why Cuban (1993a) argues that teachers are more likely to adopt reforms that are consistent with the culture of the school and which preserve the status quo. That largely explains why technologies such as the book, the blackboard and the overhead projector which extend and enhance traditional classroom practice have gained popular acceptance in classrooms. However, more complex technologies such as the computer which challenges prevailing practice are either resisted or "tailored to fit the existing contours of the age-graded school and the self-contained classroom"(Cuban 1993a, p. 198). It would seem then that the cultural environment of the school, its dominant organisational structure and general beliefs in the wider culture about what constitutes ' a real school' all coalesce to affect the level of organisational receptiveness to change.

School/Outside Relationships

A dynamic learning organisation needs to be well connected to its outside environment. In order to improve the learning environment for students and for teachers educators need to become involved with ideas and developments outside the immediate school and classroom setting. This means that schools must relate quite differently to parents, the community, business, other schools and government agencies than they have in the past and seek new ways of engaging them as partners in the educational process. If school is to have relevance and meaning in children's lives today it must be seen as a 'bridge to the future, not as a bond to the past' (Papert, cited in OECD 2001, p. 110). More widespread use of technology in schools could help facilitate this process. Not only will it make schools seem more relevant to the world in which children live but it would also help to break down traditional classroom walls by opening up channels of communication between the school and the world outside. "Increased communication is one of the biggest changes technology offers....to transcend the walls of isolation" (OTA, 1995, p. 2).

The bottom line as Sarason (1996) reminds us is that schools have to change and this change requires outside pressure. "No complicated., traditional social institution can be changed only from within" (p.339). Fullan (1991) too reminds us that external influences are needed to act as a catalyst to stimulate change in schools. Without pressure and support from government, special interests groups and policy makers many new innovations and change programs would never get formally adopted in schools.

In the end of the day however the best change efforts combine both top-down and bottom-up initiatives (Fullan, 1993). This can only come about when teachers and schools are actively connected to the outside environment and engage with the pressing issues of the times. The more schools develop their outside relationships and develop new partnerships and networks, the more they will build their internal capacity to change which in turn will give them more control over change itself. In such a situation schools and teachers will be less likely to see themselves as victims of change and more partners in the change process. Perhaps then they will be finally

in a position to refute the old age adage - "the more things change, the more they remain the same".

Conclusion

Change is difficult for all involved and it creates many tensions for individuals and for organisations. The process of change affects deep-rooted beliefs, attitudes and values which are ultimately linked with the way people see the world and believe the world ought to be. The implementation of change is a process and a phase of development in itself which requires careful management. An understanding of the four strands of change – the change process, teacher development, school culture and school/outside relationships, provides greater insight into the complexity of change and puts one in a better position to respond to change and develop strategies for planning and managing change (Fullan, 1995).

As an innovation in its own right the introduction of ICT into schools is laden with change implications. An understanding of the complexity of the change process and how to manage change is an essential component of the successful introduction and implementation of school based ICT. This fact has largely been ignored by techno enthusiasts and policy makers alike in their quest to modernise schools by inserting computers in schools without paying due attention to the process of integration (Barto, 1996) which is where the problem of change begins to surface. The people most affected by the process of ICT integration and the problem of change are teachers. It is they not policy makers who decide whether and to what extent computers will be deployed in the classroom. Ultimately the attitudes and educational philosophies that form part of the school culture is a significant factor of whether computers will be used, and how they will be used in schools. (Collis et al., 1996).

Inevitably in attempting to explore the introduction of ICT into the Irish school system as a result of the "Schools IT 2000" initiative, the issue of ICT integration, school culture and change loomed large from the point of view of the key actors, i.e. school teaching personnel. This was particularly true in the case of the Wired for

Learning project which was specifically designed and introduced with change in mind. The remainder of this thesis will examine and discuss the context in which the Wired for Learning and Thin Client projects were introduced into schools, how schools reacted to these innovations and how teacher responses to the process of ICT integration and the problem of change were influenced by the school and teaching culture.

Chapter Two

The Wired for Learning SIP Project

Wired for Learning: Philosophy and Context

It is not really possible to fully understand Wired for Learning or WFL as it is usually referred to without first understanding the wider context of IBM's Reinventing Education (RE) programme, within which this technology solution emerged. According to IBM, "Reinventing Education is the generic name for IBM's flagship corporate strategic philanthropic programme, which targets systemic, school-based change".

First introduced in the United States in 1994, the RE programme was initiated by IBM's Corporate Chairman and CEO, Louis V. Gerstner, Jr., and Stanley S. Litow, President of IBM's International Foundation and Vice President of Corporate Community Relations. Much of their thinking behind this programme is contained in a book, which Gerstner co-wrote with three other authors entitled "Reinventing Education – Entrepreneurship in America's Public Schools". Written mainly from the perspective of leading businessmen, the book is an uncompromising battle cry to commence systemic, grass-roots reform of America's public school system. The tone of the book is set in the forward where Gerstner wrote:

"This book has one purpose: to advance solutions. The battle to reinvent America's schools is not going to be won by generals, least of all by armchair generals. It will be won schoolroom by schoolroom, school building by school building" (foreword, p. XV)

The central thrust of the book is that America's public school system is in need of dire reform because it is fundamentally out of step with the demands of a high tech economy. Echoing the sentiments of "A Nation at Risk", which asserted in 1983 that "if an unfriendly foreign power had imposed our schools upon us we would have regarded it as an act of war" (cited in Gerstner et al, p.11), it argues that schools are outdated institutions, lacking the mechanism for self-renewal because as

a 'protected monopoly' they are not subject to the 'discipline of the market'. Compounding the problem is the fact that standards are dropping and American students are falling behind; the average American is less well educated than his foreign counterpart, particularly the Japanese; spends fewer days in school and school drop out rates on average are higher compared to those of many other developed countries. As a result most public schools in America's big cities have become "schools of last resort" as people with the resources move their children to private schools or suburban public schools.

"The Nation's public schools stand at an historic juncture. They are moribund institutions because they are organizations hopelessly out of synch with the realities of modern economic, social and political life. They are a bureaucratic monopoly which cannot last. If schools stay as they are they will be abandoned across the board, just as they have been in our great cities... The middle class – black as well as white – has fled. Bright flight, Not just white flight. It's not too much to assert that most of those left are those who have no choice (p. 22).... The most dismal vision of a two-class society is becoming a reality in much of the nation's urban public schools (p.6)."

Although couched in a language that is at times provocative and certainly highly emotionally charged, the fundamental concern about the state of America's education system has widespread support among policymakers, educationalists and the public at large. According to a recent Washington Post/ABC News poll (source IBM Education Policy 2001), 77% of the US electorate identified education and school improvement as the nation's top priority. Sarason (1996) reminds us that:

"In 1970, the private sector position was that schools were unique but inadequate organizations and being unique was no excuse for doing a poor job. In 1995, their position is the same, but with the difference in saying or implying that if schools go on as they have, they deserve extinction."(p.326).

He goes on to argue that the strength and scope of the criticism has increased over 25 years and there is no reason to believe that these criticisms will not continue to gain momentum. Similarly the management guru, Peter Drucker (1985), points out

that America's public schools have to change in order to avoid becoming schools for the minorities in the slums.

"For the first time in its history, the United States faces the threat of class structure in education in which all but the very poor remain outside of the public school system – at least in the cities and suburbs where most of the population lives. And this will squarely be the fault of the public schools itself because what is needed to reform the public school is already known" (p.170).

In an attempt to address the problem of widespread dissatisfaction with the public school system, Reinventing Education offers a blueprint for school reform based on the following central tenets:

- **The discipline of the market**
- **The use of technology to support student learning**
- **The creation of new relationships among schools, parents and the wider community**
- **The development of partnerships between business and schools**

The Discipline of the Market

Under the discipline of the market concept, schools are urged to modernize their modus operandi by adapting themselves to the changes in their students and the demands of society and the economy. Strategies such as listening to customers, setting goals, measuring performance, accountability, continuous improvement, rewarding success, penalizing failure, nurturing high quality leaders, developing the schools human capital (i.e. teachers) and decentralized decision making are all promoted. It is argued that the " issue in not just making schools more businesslike; rather it is to run schools like other successful organizations. Just as businesses are results-oriented, schools must also be. It is time for results in education" (p.15).

Technology

One of the key ways in which results in education can be achieved and improved is through the greater use of technology to improve school productivity. Describing the contemporary public schools as the “lowest tech large-scale activity in the whole economy; (p.235) which like nineteenth century farms are “labour intensive and low tech” (p.12), it is highly critical of the manner in which schools have failed to utilize the capabilities of new technology.

“Despite the invention of a staggering array of new information tools that store and communicate knowledge, schools transmit information as they have since Gutenberg....When schools do employ technology, they treat it most often as an add-on or extra. Computers are typically in a separate lab, to which students are periodically sent. The software they use most often has little or no relation to the curriculum in the textbooks or other materials. In most schools technology is treated like a car radio; it has no effect on performance or handling” (P.12).

The use of technology, it maintains must become a key part of any educational reform strategy as it can significantly boost the “productivity of the school by increasing the rate at which students learn, reducing the cost of instruction, or both” (p.75).

School, Parents and Community

Reinventing Education calls for a greater role and involvement of parents, community and local business in schools. Children, it is argued, will place a greater value on education and come to see education as important if parents themselves value and have a positive attitude towards education. This message is best transmitted by parents who are seen to have an active role and involvement with the school and their children’s education.

Community and parental involvement are seen as increasingly important in a society where the traditional family unit and values have broken down and juvenile disenchantment and delinquency have become the order of the day. In these

communities schools have become not just academic institutions but social services institutions as well. In such situations schools cannot and should not be expected to go it alone. To be effective they need to solicit the power of community and parents to help them. To leverage this assistance schools need to let communities know what resources they need and why.

They also need to build more effective partnerships with parents who are both the schools primary customers and potential co-workers in the education process. Both of these tasks require the capacity to communicate much more intensively with “parents, taxpayers, legislators and others in the local community. The problem with this however is that “few institutions in modern society are worse at communication than schools” (p.81). The key then to creating these new relationships is to develop new and more effective ways of communication.

Business/School Partnerships

The book makes no bones about the rationale for the development of business education partnerships, which is not entirely altruistic. Its key rationale would appear to be self interest as it views business as a major stakeholder in the issue of education quality and reform:

“The business interest is simply in having an educated citizenry that can take its place alongside the world’s best workforces.. The workforce of the high-performance organization in the global economy is one that must be made up of autonomous problem-solvers, men and women, who can think for themselves, reason and troubleshoot, and continue learning on the job... When the workforce is understood in this light, the needs of business and society as a whole are drawn together. The historic mission of the school – to educate the whole person, not just the prospective job-seeker – is now precisely what is needed for employment in the modern world (p.90) ... The truth is that the modern firm cannot train if the school has not educated” (p.10).

More recently similar comments were expressed by Stanley Litow, President, IBM International Foundation, who spoke candidly about this self-interest when he said;

"It's hard to imagine that you can have an effective company in a community that doesn't work. That's why well functioning schools are so critically important to the stability of a community and all of its businesses. You can say that we have self-interest because we expect to be able to hire high quality workers and have high-quality customers. But without communities that work, businesses are at risk." (Clyde 2000, p. 5)

Another rationale for the business/education partnership model is that business is viewed as the only major stakeholder, sufficiently organized to put pressure on the school system to change. In addition because businesses themselves have had to change in response to a changing economy and society, they have developed strategies and solutions to deal with the problem of change. These strategies it is argued have a direct bearing on schools. In this context business is seen as having a "special responsibility to help, both with its ideas and with its insistence on a businesslike approach to the national school problem" (p.92).

Furthermore business also has a responsibility to shift resources, comprising both money and volunteer help, to the schools that need it most. This does not mean that business should be expected to support regular operating and capital expenditures, which should remain the preserve of federal and state budgets, but rather that business can help to pay for "innovation, investments in new programs, and experiments that can be replicated with public funds" (p.271).

The Reinventing Education Grant Programme

If Reinventing Education, the book, outlines IBM's philosophy on why schools need to change and a vision of how that change can be implemented, then IBM's Reinventing Education Grant programme represents the organisation's attempt to transform that vision into action. To put it more bluntly, they have put money where their mouth is. The Reinventing Education grant programme forms the centerpiece of IBM's global commitment to education and it is the vehicle through which IBM contributes its expertise and knowledge to spur and support school reform efforts throughout the world. To date approximately \$70 million dollars has been invested in the programme.

Described by the Centre for Children and Technology (2001) as a “unique initiative among the efforts to reform education” (EDC press release, p.1) and by the Harvard business school (2000) as “a new paradigm for strategic corporate philanthropy” (cited in Litow, p. 2), the program’s goal is to transform US public school education. The manner in which it proposed to do this was through establishing working partnerships with schools whereby IBM could apply its R&D resources, and use its technical and management expertise to work with educators in developing practical solutions to systemic barriers in education reform.

The concept of partnerships with schools is the cornerstones of the Reinventing Education Grant programme. Viewing its school partners as valued business partners, IBM was committed from the outset to the long haul. It established three to five year partnerships with its Reinventing Education Grant sites that went beyond traditional corporate feel good philanthropy where engagement has tended to be shorter and the involvement more hands-off.

“I want to go beyond traditional business partnerships that enhance schools by providing equipment, mentors or increased opportunities for students and teachers. While these generous efforts may brighten the picture for a few children, they do not change the “system.” (foreword, p. ix)

For IBM, partnering with schools involved more than just donating technology or money. It involved throwing the weight of its expertise behind schools that wanted to change and were prepared to take risks. It did not expect advanced information technology alone to transform schools, although it viewed technology as having a key role in this process. Its operational framework for the successful transformation of schools was based on a complex multi-step Continuous Improvement model, which each successful grant site was expected to adopt.

Continuous Improvement Model
Focus: Student Achievement/Success

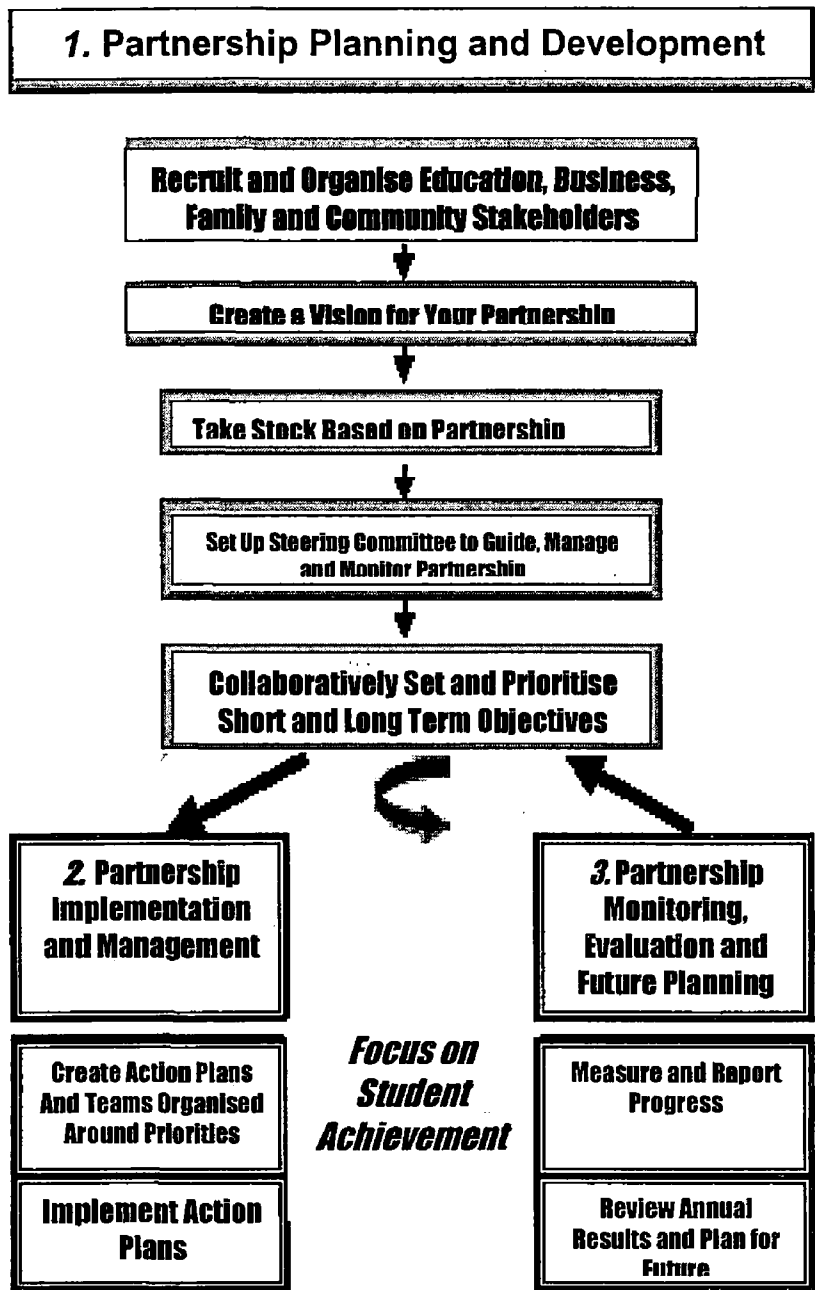


Figure 3, Source: Investing in Partnerships for Student Success: A basic tool for Community Stakeholders to Guide Educational Partnership Development and Management, US Department of Education.

Professor Rosabeth Moss Kanter of the Harvard Business School (2001) has described the RE programme as a role model for corporate philanthropy precisely because of the emphasis it places on partnership and its long-term commitment to work with school systems in applying technology solutions to create meaningful solutions.

“There are many companies that do interesting and useful things with education, but they don't have long term impact – like sending volunteers into schools to tutor. That's a useful thing to do, but it doesn't transform the nature of the school system. Reinventing Education is aimed at transformation, and a kind of transformation that will bring schools into the same modern Internet-enabled digital world that businesses have been getting into”.

(<http://www.ibm.com/ibm/ibmgives/grant/education/programs/reinventing/kanter.shtml>, p. 1)

In the US where the programme was first initiated, IBM used a Request for Proposal process to identify partners that were “ripe for sustained, systemic change.” According to the Center for Children and Technology (2001), it deliberately selected school districts and states that:

- Were able to identify specific problems amenable to innovative technology solutions;
- Would make Reinventing Education an integral components of their reform efforts;
- Would face the challenge of scaling the successes of the program to other schools in the district and state.

In essence it was looking for partners who had a track record for innovation and improvement, not necessarily the highest performers. In addition, it deliberately targeted schools operating in tough environments, mainly in large urban districts and selected rural areas, which had their own difficulties to overcome.

In the first phase of RE, which commenced in 1994, grants were awarded on a staggered basis to ten US sites to tackle the problem of school reform. IBM gave

grants of approximately \$2 million each to these 10 sites to create customized solutions. Nine of these sites went into full implementation. In 1997, a second round of grants was awarded to twelve additional U.S. locations to build on the knowledge and experience and technology solutions developed through the original sites. To date the initiative spans the length and breadth of the US – from California to Florida and from Vermont to Texas and serves more than 10 million students. The programme has also been extended to provide RE grants to eight international sites around the world in Ireland, Italy, the UK, Brazil, Mexico, Singapore, Vietnam and Australia.

Since its inception, RE has been the recipient of a number of prestigious awards including Winner of the Council of Foundations' *2000 Scrivner Award*, the Conference Board's 1999 *Best in Class Award* and the Council for Aid to Education's 1998 *Leaders for Change Award*. In terms of its commitment to systemic change and long term involvement with schools through a partnership approach, IBM has joined the vanguard of a number of philanthropic foundations who in the course of the last decade have adopted a more strategic approach to the question of systemic reform of education in the United States. The most well known of these include the McConnell Clark Foundation 'Program for Student Achievement,' (1989) the Panasonic Foundation 'Partnership Program' (1987) and the Rockefeller Foundation 'Building District Infrastructures (1994). As their experience testifies, "school reform is a messy, complicated, often frustrating challenge that requires patience and staying power" (Kronley 2000, foreword, p. 111) and is contingent on at least two factors; firstly that educators and policymakers really want to change and secondly that they know how to bring about change and have the skills and capacity to implement it (Kronley 2000).

Wired for Learning and Reinventing Education – the Irish Context

A Reinventing Education partnership was mooted for Ireland in September 1997 when Stanley S. Litow from IBM met with the then Minister for Education and Science, Micheal Martin T.D., to explain the Reinventing Education program and demonstrate some of the solutions that had been created. He indicated that IBM

would be willing to partner with the Department, if the Minister and his officials were interested. The Minister expressed his enthusiasm for such a partnership and particularly for the Wired for Learning tool, a communications vehicle to enable the delivery of information through the World Wide Web.

Following on from this meeting, the Reinventing Education in Ireland project officially came into being on June 25, 1998, with the signing of the Letter of Agreement between IBM and the Department of Education and Science (DES). As a result Ireland became the first European country to receive an IBM RE grant, worth \$1m. for the purpose of research and development, new technology application and equipment. DES committed to match the funding which IBM was prepared to invest in the project.

Fortuitously, the timing of the project coincided with the Launch of the Government's "Schools IT 2000" initiative, whose policy document endorsed the principle of partnership between education, business and community sectors through the vehicle of the National Centre for Technology in Education (NCTE).

"A key objective of Schools IT 2000 is to bring about a national partnership involving schools, parents, local communities, third-level colleges together with public and private sector organizations to meet the project's ambitious aims. The government's investments of £40 million in the programme will be significantly enhanced and supplemented through the efforts of the Project's partners. "

(www.irlgov.ie/educ/it2000/summary.htm, p.1)

This emphasis on partnership was again stressed by the Minister for Education and Science who, at the launch of the second site to join the WFL project, in September 1999, said:

"School's IT 2000 places a great emphasis on developing partnerships and making Ireland an international center of excellence in establishing best practice in the use of ICT's in education. In this, there is a tremendous synergy between our objectives and those of the IBM worldwide project "Reinventing Education".

(www.irlgov.ie/educ/speech1/1990924a.htm)

By the time the Wired for Learning project got the official green light, the NCTE was already established and it was decided that the coordinator for the SIP program would manage the project on behalf of DES with IBM's appointed project manager.

In this respect, the project differed somewhat from the normal SIP model whereby schools identified a project they wished to pursue and applied to SIP for funding and support. In other words innovation was encouraged at the school level by means of a bottom-up approach. Here we see a break with this criterion as we now had a project initiated at a top level, slotted into the SIP programme, in search of schools in which it could be implemented. It's a fact that did not go un-noticed by some of the project participants, one of whom said:

"WFL is a strange category, I gather it's unique among SIP projects and I did have a look at the whole catalogue of SIP projects last year. WFL was tucked down behind – the last one, and at the time I said this is the only one of all the SIP projects that would not directly involve children...."

In the broader scheme of understanding the project's development in Ireland, the significance of this 'top-down model' and the manner in which schools were 'chosen' to participate in the project, should not be underestimated, as it had a direct bearing on how some of the participating schools reacted to the project's implementation. Also of significance in this context was the fact that it was decided to announce the project partnership in August, 1998, at a time which coincided with the visit to Ireland of IBM's Corporate Chairman and CEO, Louis V. Gerstner Jr., whom as was mentioned earlier was also the brainchild behind the Reinventing Education programme. This meant that the first three project schools had to be selected when teachers were on holidays, the schools were closed and the principals involved did not have the opportunity to discuss the matter with the teachers and parents before the public announcement. Both on and off the record comments in the course of this research indicated that this situation was less than ideal. One principal commented:

Introducing the project was kind of difficult. Introducing something new is always difficult but the way in which it happened over the summer holidays (also made it difficult). What happened was I got the information during the summer holidays that we were going to be one of the schools in Site One. So then I had to come back to the staff (in September) basically with the signed and sealed decision, so the non-consultative things was probably not the most desirable things, because really ownership requires consultation.. I have to say then that there was a struggle along the way...It was a fait accompli in a sense because we had been chosen and were in it, willy-nilly, well obviously that wasn't an easy ride".

Privately another principal commented that the launch coincided with Louis Gestner's visit to Ireland to play golf and that at the official launch of the project in August 1988, the participating schools, although present, were effectively ignored and regarded as unimportant. While objectively the accuracy of this comment may be subject to question, subjectively it speaks volumes about how some key stakeholders were made to feel by the powers that be and that undoubtedly had repercussions for the project's development in some schools.

From the very beginning it was planned that there would be three sites in Ireland where the Reinventing Education programme would be implemented, one in Dublin, one in Cork and one in another geographic location, to be identified. It was envisaged that each site would consist of between one and three schools. The first site based in Dublin comprised a cluster of 3 schools, both primary and secondary. They joined the project in August 1988. The second site, comprising two schools, a primary and secondary school in Cork came on board in March 1999. The project was extended to a third site in Dundalk a year later. Operating under the auspices of the "Dundalk Learning Network", this site comprised eight schools representing both the primary and secondary sectors. The research work carried out for this dissertation involves sites one and two only, i.e. the Dublin and Cork sites.

One final point worth noting is that early on in the project's history, during the autumn of 1988, when extensive meetings and workshops took place with the participating teachers from site one, it was decided to call the Irish project "Wired for Learning" based on the project tool which was being implemented, rather than Reinventing Education, which is the generic name for the programme. Reading

between the lines it would appear that Irish teachers and DES officials were uncomfortable with the Reinventing Education title and its connotations. As one participant said:

"I think IBM didn't really know that much about the educational system in Ireland and they also went in with the attitude of we are going to change things here, and they didn't realize that maybe we did not want to be changed that much, maybe we were changing in our own way and for the good and their way of doing it wasn't necessarily the best. I mean even calling it "Reinventing Education", that kind of told a lot about what they were doing. Teachers don't want to be reinvented by a multinational".

From a pragmatic point of view, changing the name to suit local sensibilities was no doubt a smart move, and indeed the more practically minded might be inclined to say that 'a rose by any other name smells just as sweet'. However language and communication theorists would argue that words have their own significance and meaning and that changing words can have a profound effect on how we view and interpret things. In this context it could be argued that the term "Wired for Learning" represented a dumbing-down of what the Reinventing Education programme was fundamentally about, and that in the Irish context, the project changed from a change programme in which technology was part of the solution, to an IT project where the pre-dominant focus became the technology. Be that as is may, the fact is that in Ireland the project became known only as 'Wired for Learning' and that is the term which will be used for the Irish project from here on out in this dissertation.

The Wired for Learning Tool

In the interests of clarity and to avoid confusion, it is important to make a distinction between "Wired for Learning" the project and "Wired for Learning", the technology. As already outlined in the previous section, "Wired for Learning" became the colloquial term for the Irish Reinventing Education programme. The term was adopted from the "Wired for Learning" technology tool, around which the Irish programme was focused.

In the strictest sense of the word however, Wired for Learning (WFL) is the name of the software solution specially designed and developed by IBM under its RE programme, specifically for use in schools. WFL was the first of four software tools to be developed under this programme. It was developed by the Learning Technologies Group at IBM, whose researchers worked with educators in the Charlotte-Mecklenburg Public Schools District in North Carolina, to find new ways that technology could help connect homes to schools. Charlotte-Mecklenburg was among the first recipients of an RE Grant in 1994. Its project focused on increasing communication about teaching and learning between various stakeholders who are critical to improving student learning.

The first version of Wired for Learning was released in 1996. According to one of its developers, Cynthia Vincent, it was designed with four user groups in mind; "teachers, parents, students and mentors" (Hall, 1996, p.2) in order to facilitate communication and collaboration among members of the education community. Because it is a web based program users can log on anytime, anywhere. This means that teachers, students, parents and mentors can access WFL communication and collaboration tools at their convenience by using any school or home computer with Internet access.

The bulletin board interface deployed by WFL gives parents the ability to view posted student assignments and special projects, and conduct online private conversations with teachers. Teachers can communicate and collaborate with their students, and students' families on educational issues. Teachers can also communicate and collaborate with colleagues on educational planning, research and other professional development activities. Students can participate in classroom projects, team projects and discussion forums online. Interested members of the community can use Wired for Learning to contribute their expertise and support to their local schools.

Wired for Learning and Lotus Notes

Wired for Learning is a communications vehicle that combines the power of the internet with the security of Lotus Notes to connect teachers, students and parents.

Lotus Notes is a distributed client/server application which combines two technologies – shared databases and messaging (i.e. e-mail) - which supports groupware. The term groupware is a “loosely defined concept that refers to a type of application that enables groups of people to collaborate together to create, share and use information more effectively” (Introduction to Lotus Notes, p. 7). Groupware or computer supported cooperative work (CSCW) as it is sometimes called (Roddin, 1991), promotes working together in teams and it relies heavily on networks for the transfer of information among individuals and organizations. As many organisations adopted a teamwork management style throughout the eighties and nineties, groupware products like Notes that facilitated online communication, collaboration, conferencing and work co-ordination became quite popular.

Lotus Notes was developed by the Lotus Development Corporation, which IBM acquired in 1996. Lotus Notes was the first Windows based groupware package and continues to be the most fully functional groupware package in the market today (Sinclair and Merkow, 2000). Although Notes predated the web, it had a natural affinity with it, as one of Notes’ greatest strengths was its capability to transfer information over Local area networks (LAN’s) and Wide area networks (WAN’s), telephone lines and the Internet. Consequently as the web evolved, Lotus Notes evolved too, to ensure its compatibility with this emerging platform. It is probably true to say that more than any other technology, Notes helped to define and drive the groupware market.

The basic building blocks of the notes environment are Applications. In Notes applications can consist of single or multiple databases that store information. To search and sort information a user can create many different ‘views’ to display and retrieve stored data. The Notes workspace stores icons that represent the databases available to each user group of users. To open these databases the user simply double clicks the appropriate icon. Once open a Notes database typically contains the following features:

- An Action Bar at the top of the screen which contain buttons the user can click on to quickly perform some common tasks such as ‘respond’, create, navigate etc.

- A navigation Pane located left of screen that opens different folders and views
- A view pane which forms the main screen view that allows the user to select and open documents
- A Preview pane that lets the user read the document that is highlighted in the view pane without opening the document

In Notes, data can be imported from and exported to a range of graphic, word-processor and spreadsheet formats on all platforms. The metaphor is that of an existing office, classroom or organization (Mc. Connell, 1994). Anything that already exists on paper can be converted into Notes databases to be made available electronically. Groups can communicate using the sophisticated conferencing and emailing system built into the Notes architecture. Documents such as text, graphics, spreadsheets and sound can be attached to any personal or group communication.

The Wired for Learning software shares most of the features of a standard Lotus Notes environment. All of the WFL applications are databases that store information created by WFL participants. Because the WFL framework is modular, many different educational applications can be installed depending on the school or district needs. The databases are relational, meaning that the information can be shared and accessed through most of the applications. In addition all of the information stored in WFL can be sorted and organized in different ways as indicated in the navigational menu. All WFL applications are fully searchable and all material can be shared with colleagues at the discretion of the WFL participant. As Lotus Notes is platform independent, WFL supports many operating systems including Mac, Unix, Windows 95 and NT. Only an Internet connection and web browser are required.

Like Lotus Notes, WFL uses a powerful security system to authenticate users logging into the system. This means that all users must register on the site before being admitted, thus ensuring that data on the system is maintained with the highest degree of security. This is very important in a school context where all information on students and conferences between parents and teachers and discussions among teachers must be kept private. At a time when there is growing concern among

teachers about the openness of the web and the manner in which the vulnerability of children can be exploited through this medium, this is undoubtedly an added benefit of the system.

Since the development of Wired for Learning, three other software solutions have been developed under the auspices of the Reinventing Education programme. These are:

- **Watch Me Read** – a literacy software package
- **Data Warehouse** – a software tool to integrate school-based data and to promote accountability
- **Visual Venture** – a software tool to strengthen and integrate the science and math's curriculum in K12 schools.

All of these packages can run under the Wired for Learning environment or independently. A more detailed account of these packages can be found at www.wiredforlearning.net/. As Wired for Learning is the main focus of this study the next section examines more closely the Wired for Learning environment as experienced by users of the system in Irish schools.

The Wired for Learning Environment

The wired for learning environment is made up of a suite of tools or applications that support communication, collaboration and learning. These tools support Wired for Learning's philosophy of expanding the learning environment by enabling collaboration with students, teachers, parents and mentors both locally and globally, thereby helping to eliminate time and space constraints. These tools make it possible for parents to view homework assignments, read teacher evaluations of student progress and conduct on-line, private conversations between teachers and parents.

Access to the WFL environment is facilitated via a standard web browser. To enter the environment as either a guest or registered user, you simply type in the school's domain address. A guest participant has limited access to the applications within

WFL. While it is up to each school to decide which applications will be made available for guest viewing, a typical guest home page is likely to be laid out in accordance with the illustration below. Guests can apply for registered user status by entering the Registration and Directory database and filling out the appropriate registration form.

Each registered user on WFL has a unique user name and password that must be completed at each log in. A registered user is someone (i.e. a parent, teacher, mentor or student) who has been registered and approved by the WFL System Administrator. A registered user's home page, while similar in layout and design to the illustration below, will contain a more extensive set of application tools for the user to access.

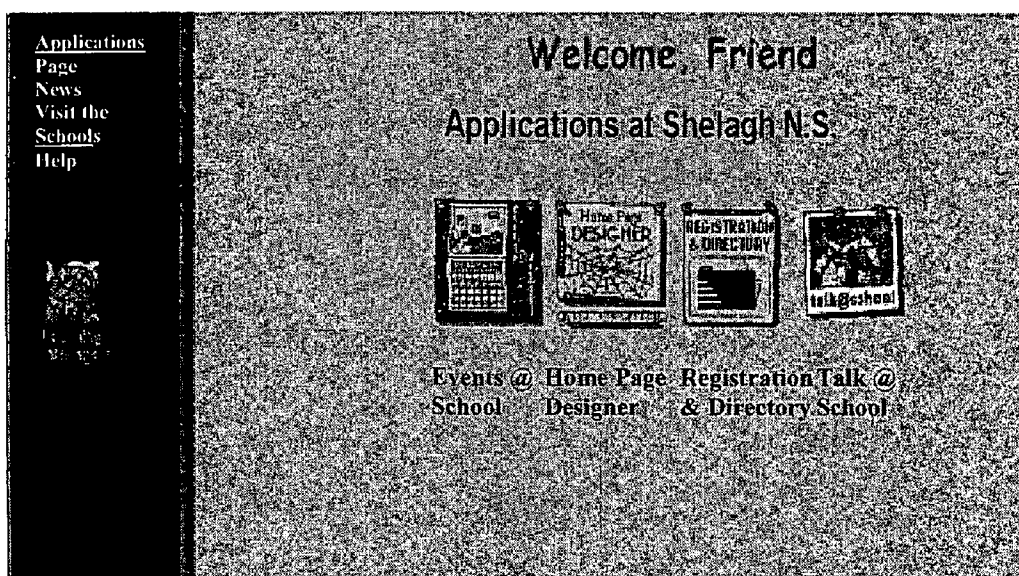


Figure 4: The WFL home page has a chalkboard-style section on the left (**Navigation Menu**) and a bulletin-board section on the right (**Application Page**). The Navigational Menu has different options for sorting and viewing information for each WFL page. It also has **hyperlinks** to jump to other pages within the WFL program

Navigating in WFL

Navigating within the WFL environment is straightforward and user friendly. The main application page on the right of the screen contains all the functional

components of WFL. These can be accessed by clicking on the appropriate icon. The navigational menu located on the left side of the screen offers users multiple options for sorting and viewing information, as well as hyperlinks that allow users to jump to certain screens within WFL. While the choices available on the navigation menu will vary within each functional area, the Application Page and Help hyperlinks are always available.

Each application when accessed follows a similar design style and pattern. The main screen with its thin blue lines has a copybook motif with an accompanying toolbar at the top containing Action Buttons such as : [collapse](#) [expand](#) [search](#) [create](#) [respond](#). Threaded discussions are indicated by a blue triangle or Twistie as it is called in WFL, located to the left of a discussion topic. Clicking on the twistie will open or expand the threads of discussion for viewing. Once open, clicking again will close or collapse the threads of discussion.

A standard fill in the blank Template is available within most applications. Following a standard database protocol, the template contains Data Entry Field Boxes, Drop Down Menus and Radio Buttons. A Pencil Icon located next to a data field indicates that the field must be filled in. The consistent look and feel within each application makes WFL a very easy system to learn and master.

Communications Applications

The Communications applications in WFL provide a secure email environment in which teachers, pupils, parents and mentors can conduct discussion forums. Security is guaranteed through the registration process, which means that only approved registered users can participate in discussions. In addition the system administrator can limit the type and level of access available to each individual. The four key communication applications in WFL are:

- **Private Conferences**
- **Home Page Designer**
- **Events@School**
- **Talk@School**

Questions marked by the pencil require your response (V)

REGISTRATION & DIRECTORY

Applications
page
My Registration
Details
Registrations
Staff
Others
Help

Street
City
County
Post Code
Home Phone.
Work Phone.
Best time for you to be contacted by the school
Best time for you to be contacted by the students
Most recent employment
Position

User type:
Mentor
Mentor
Parent
Principal
Student
Superintendent
Teacher

reen to refresh if you select another user type.

Figure 5: Sample Application Screen illustrating the Registration process. Note the copybook motif and the database template common to most applications in WFL . Note too how the navigation menu on the left screen is always available.

Private Conferences provide an online forum for private discussions among selected users in a secure environment. Private Conferences are stored in a threaded discussion database and participants can log into Private Conference at a time and place convenient to them. There are three basic types of private conferences:

- Teacher/Parent
- Teacher/Student
- Teacher/Teacher

Only a teacher can initiate a private conference although parents and students can request one. Once a teacher creates a private conference, the registered parent and/or student can participate in the conference. Private Conference can be used as a tool to increase parental involvement in the student's learning process, especially

in a situation where a student may be experiencing difficulties with homework assignments and other school related matters. It can also be used to facilitate communications between class teacher and learning resource teachers and home/school liaison personnel.

Home Page Designer enables each teacher to create a personal home page for student, parent or community viewing. Teachers can communicate homework assignments, the class calendar, learning resources and other important information to parents. Students' work can be posted on the home page. It is up to schools to decide who will have access rights to the Home Page Designer. Some schools will limit this to teachers only while other schools may give creation rights to students, class groups and other organizations.

Like other WFL applications, Home Page Designer has a template worksheet that teachers fill in to create home pages. Although it is not necessary to have knowledge of HTML, the home page can be enhanced with HTML. While the WFL comes equipped with clipart, teachers can also add graphic and digital photos to their home pages. Links to favourite websites can also be included.

Events@School is a web-based calendar of school events and activities, which keep students, teachers, parents, mentors and the community at large informed of school activities. Registered users can access information that may include:

- Important dates such as school holidays
- Sporting Events
- Meetings (Parent/Teacher, Staff, Board of Management)
- Committee, club or group activities
- Staff Development sessions or other workshops

It is possible to include several calendars with unique icons and with different user access. In this way administration staff and teachers may have their own calendars, school clubs another and school functions yet a different calendar. It is up to the school to decide who has access to view each calendar. The Calendar shows events

on a daily, weekly, monthly or yearly basis. Any events that are entered and viewable through the calendar view are links that return more detailed information about the event.

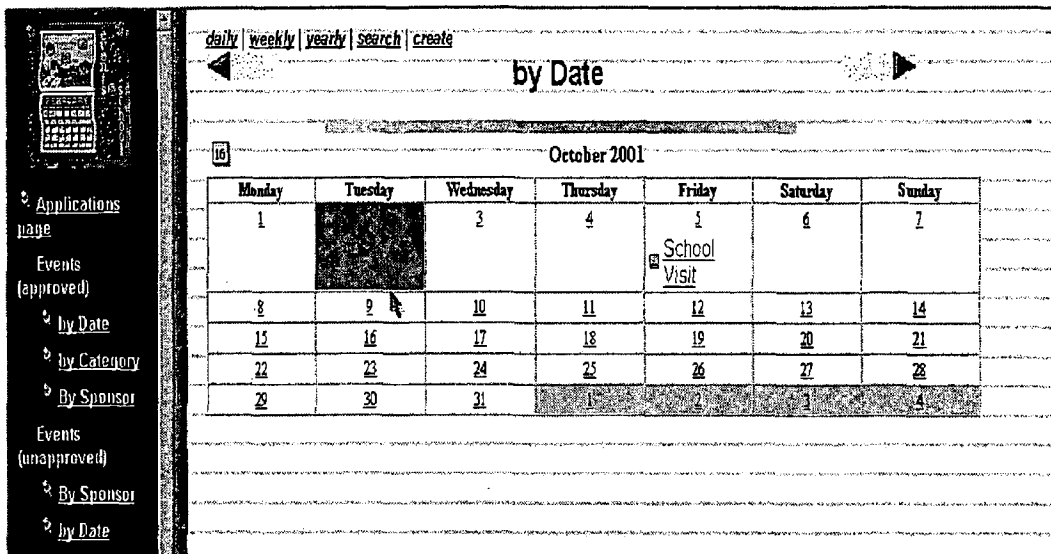


Figure 6: Sample illustration of WFL Calendar

Talk@School is a web based discussion forum devoted to community-based discussions on school related issues. The discussion are is open to anyone with a user ID and password to the Wired for Learning site who has been given access permissions to the Talk@School application by the school. In this forum, parents, students, teachers and mentors can communicate about current trends or issues facing the school community.

Collaboration Applications

WFL encourages and facilitates the development of collaboration skills for both students and teachers through the following applications:

- **Team Projects**
- **Mentors@School**
- **Teachers Lounge**

Team Projects is a collaborative application where students can collaborate with their peers, teachers and mentors. In a team project assignments are carried out by students using a discussion forum focused on one or more assigned activities. Team members create responses to each activity and comment on each other's work. Mark-up tools enable teachers to make paper-like comments to be added to any student response.

A team project is created by the teacher. It may be configured so that only teachers and students can view the work. Alternatively parents and mentors can be involved either as participants or viewers. With the current emphasis in the business world on developing teamwork, team projects can provide students with a useful insight into this method of working.

Mentors@School allows registered mentors to bring their expertise online to the school. Mentors can be members of the local community or residents from outside the locality who have some expertise that teachers and students wish to tap into. Mentors can be used as homework buddies, classroom speakers or presenters simply to answer questions in their area of expertise

Teacher's Lounge is designed to meet the needs of the teachers using WFL by allowing communication and collaboration among themselves in a private online environment. Teachers Lounge consists of discussion topics posted by and responded to by teachers. These postings and responses take the form of a threaded discussion. Teachers can use this application to solicit help or advice on resources, teaching strategies, creative ideas, classroom management techniques and other classroom related topics. It is a convenient and useful way of gathering and sharing information among colleagues.

Instructional Planner Application

The Learning process in WFL is facilitated by the Instructional Planner application. The Instructional Planner is a suite of related databases that teachers use to create entire Instructional Plans. The Planner includes the following databases:

- Unit Plans
- Lesson Plans
- Activities
- Resources
- Assessments

All of these components, when used together, complement and build upon each other allowing teachers to create meaningful activities that tie into lesson plans and complete units of study.

The Instructional Planner also makes it possible for teachers to collaborate with one or more individuals when creating plans, sharing finished plans and keeping their plans private as they work to improve the content. Teachers can also copy shared plans created by other teachers and personalise them for use in their classroom. The Instructional Planner is a powerful tool that can enable teachers to make rich instructional plans that will benefit students.

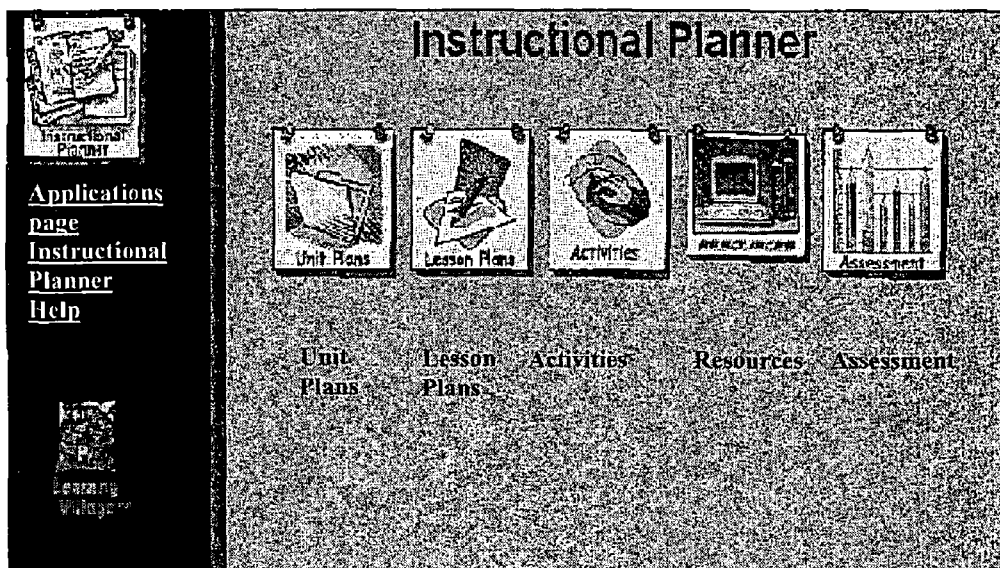


Figure 7: The Instructional Planner has an icon for each database available to teachers. Depending on a school' or District's choice about its WFL implementation, some icons may not appear on the Instructional Planner opening page. The five databases and their associated icons illustrated above, represent the databases originally available to the 5 Irish schools.

In the Instructional Planner, plans are organised as units of study. A unit plan consists of a set of one or more Lessons, their associated Activities, Resources and Assessments. The unit Plan is centered on the program of work on any topic. Unit Plans can be organised by theme, grade, subject, course, teachers or by standards.



Unit Plan: Shakespeare	
Table of Contents	
Lesson Plan 1: Shakespeare: His Life and Times	
	Activity Plan 1: Shakespeare: Renaissance Culture
	Activity Plan 2: Shakespeare: Oral presentation on historical figures
	Resource 1: Shakespeare: Internet References
	Resource 2: Shakespeare: Library materials
Assessment Plan: Shakespeare: His Life and Times	
Rubric: Oral Presentation Criteria	
Lesson Plan II: Shakespeare's Comic Vision	
	Activity Plan 1: Shakespeare's Comic Vision: The Twelfth Night
	Resource 1: Shakespeare's Comic Vision: "Shakespeare's Comedy"
	Resource 2: Shakespeares' Comic Vision: "Comic Conventions in Twelfth Night"
	Activity Plan 2: Shakespeare's Comic Vision: Analysis of comedic features
	Resource 1: Writing a Literary Analysis
Assessment Plan: Shakespeare's Comic Vision	
Rubric: Essay Writing Criteria	

Figure 8: Sample Unit Plan illustrating the inter-related databases: Source IBM WFL Manual

Depending on local requirements, lesson plans may be constructed individually or part of an existing unit. Like Unit Plans, lesson plans can be organised by grade, subject, teacher etc. The heart of this application is a searchable database of teacher-designed lesson plans each of which may include multiple activities, resources and assessments.

Teachers create lesson plans using WFL template screens that walk teachers through the online process of building detailed lesson plans. A series of Data Entry Field Boxes and Drop Down Menus makes it a straightforward and easy process. Teachers can also choose to have other teachers as editors or reviewers of their lesson plans.

As with Unit Plans, lesson plans may be kept as drafts, in which case only the creator has access, or shared with colleagues. In addition teachers can view, copy and modify for their own use lesson plans that have been created and shared within WFL. Both Unit Plans and Lesson Plans can include any number of 'comment' documents. These documents can contain file attachments to include audio, video, MS Word documents and other files with units and lessons. Any Unit or Lesson Plan with an attachment will contain a paperclip icon indicating that a downloadable file is attached.

The activities, assessments and resources applications can be connected to Unit and Lesson plans or be used as stand alone instruments by themselves. The activities database includes activities that support the instructional goals or objectives of the Lesson to which they are connected. Activities include descriptions and procedures as well as resources and assessments for the activities.

The Assessment application describes a plan for how a teacher will assess student mastery of the lesson or activity objective. As such it documents what assessment and instruction activities have been built into the Unit/Lesson Plans.

The Resources application is a searchable electronic library or reference database of resources collected by teachers. The Resource database may identify traditional resources such as books, videos, and supplies, or include electronic resources and references such as Internet sites and film and audio files.

IBM ® WFL (™)Instructional Planner

Graphical Overview

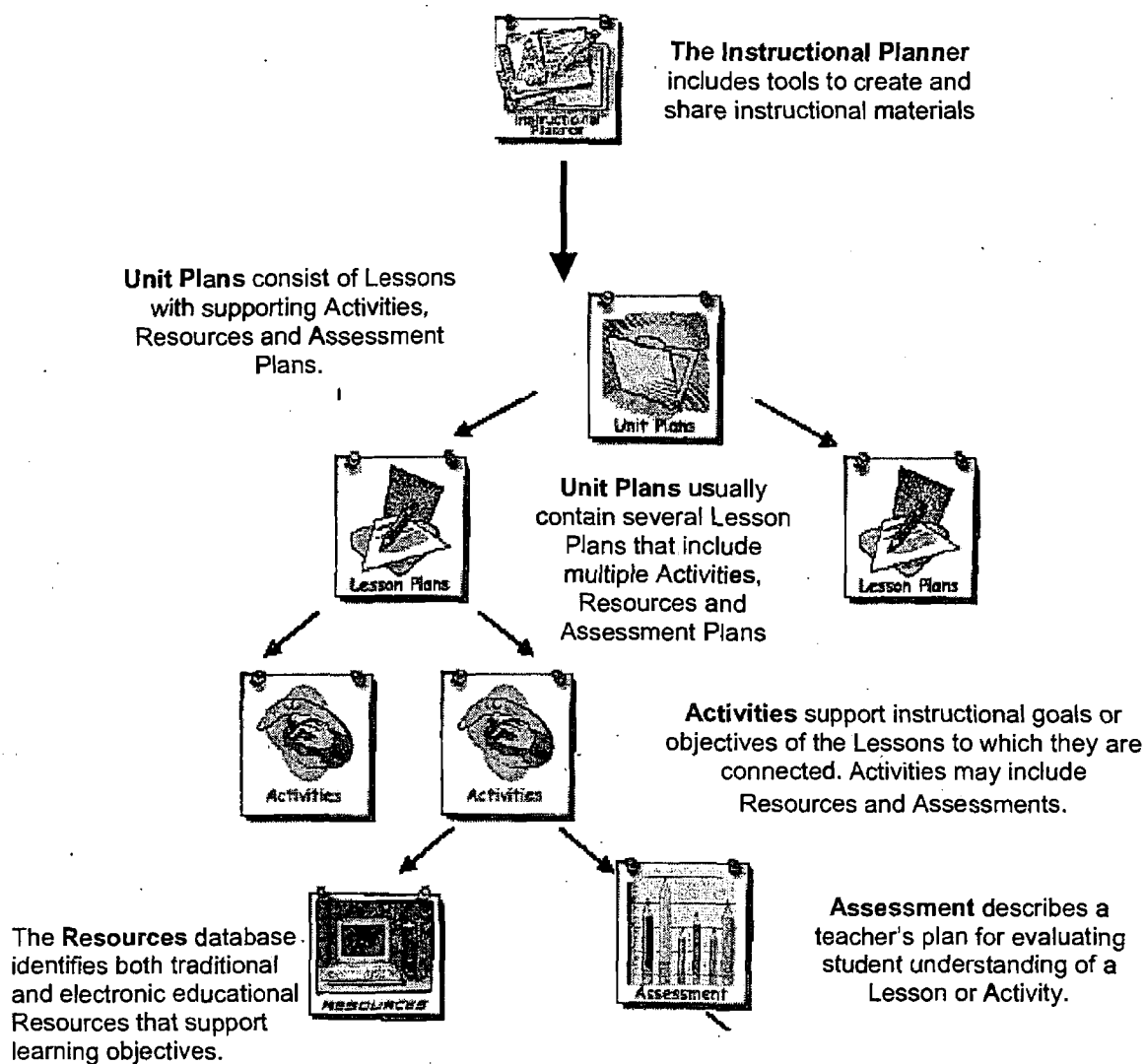


Figure 9: Instructional Planner Application: Graphical Overview:Source IBM WFL Manual

Wired for Learning (WFL) , Computer Mediated Communications (CMC) and Computer Supported Collaborative Learning (CSCL)

Within the broader context of educational technology, WFL can be classified as a sophisticated Computer Mediated Communications (CMC) system. Ellsworth (1994) describes computer-mediated communications, as communications between different parties separated in space and/or time, mediated by interconnected computers, which come in two forms known as synchronous and asynchronous CMC.

As computer and communications technologies evolved and converged during the 1990's a range of CMC tools, products and systems emerged with increasing levels of sophistication and ease of use. These ranged from more basic communication tools such as email, bulletin boards and news groups to more elaborate collaborative products such as computer conferencing [FirstClass] and video conferencing [CU-See-Me] to very sophisticated systems containing entire integrated learning environments such as WebCT, Lotus Learning Space and Top Class. In terms of technological sophistication and range of features, Wired for Learning is more closely affiliated with these latter systems. This needs to be qualified however by pointing out that while the former are more geared towards the third level sector with particular appeal for the distance education community, Wired for Learning was specifically designed with the first and second level sectors in mind.

It is also broader in scope and intent than some of these other CMC systems as it was specifically designed with education reform in mind. In this respect it is a good example of what Hooper and Rieber (1995) describe as an 'idea' technology. They argue that educational technologies can be classified as either 'product' or 'idea' technologies (p.156). The difference is that 'product technologies' support the established practices and beliefs of teachers while 'idea' technologies seek to transform them.

The potential value of CMC as an 'idea' technology' for transforming education has long been acknowledged. As far back as 1989 Kaye maintained that CMC can be

used as a powerful tool for group communications and co-operative learning while Harasim (1990) claimed that CMC provides unprecedented opportunities for educational interactivity.

While the collaborative and interactive capabilities of CMC were first noted and utilised by distance education providers, where to date they have also had their greatest impact, increasingly with the growing popularity of the internet, CMC is also being used in more traditional classroom environments across all education sectors. With its ability to breakdown classroom walls, Dyrli and Kinnaman (1996a) maintain that CMC brings immediacy and individualisation to the curriculum and present students with unique learning experiences to which they would not normally be exposed (Dyrli and Kinnaman 1996b).

As a sophisticated CMC system, WFL also encapsulates the transformative potential of CMC, but arguably it takes the notion of an 'idea' technology' a stage further than many existing CMC tools. This can be attributed to WFL's affiliation with Lotus Notes, a product, which, as was mentioned earlier, belongs to a family of groupware products whose 'raison d'être', is to support computer supported cooperative work (CSCW). McConnell (1994), makes a useful distinction between structured and unstructured groupware. The latter encompasses email, bulletin boards and computer conferencing systems. These are termed "unstructured because they do not have any pre-defined structure which tries to model some observed 'real situations'. They are essentially electronic spaces into which users place textual communications and impose their own structures in as much as the software permits" (p.37). In contrast "structured groupware is designed to provide structure and support for people electronically working together". This form of group work is generally referred to as computer supported cooperative work" (p.34).

When first designed, CSCW systems like Lotus Notes, were specifically targeted at organisations with the expressed intention of improving organisational effectiveness and promoting organisational learning, regarded as essential for survival in the modern knowledge economy. As such the 'human system' (i.e. the idea technology) and the 'tool system' (i.e. the product technology) are equally important (Engelbart and Lehtman, 1988). The same cannot be said of unstructured groupware products,

which differ fundamentally in their intent and can be classified more as product than idea-based technologies.

CSCW with its emphasis on group collaboration and communication for the purpose of enhancing organisational effectiveness and learning, spawned the development of another 'idea' technology, of specific interest to educators, Computer Supported Collaborative Learning (CSCL). Ambitious projects like Athena (1983) at MIT, Boston, The ITOL (Information Technology-based Open Learning) model (1989) in the UK and many other telematic projects sought to emulate the capabilities of CSCW systems and tailor them to the needs of educational users. Broadly defined the term "CSCL" can be used to cover any form of cooperative learning communication that occurs over a network of computers that exploits the storage, process and retrieval capabilities of the computer for teaching and learning (McConnell 1994). Some of the key characteristics of CSCL systems include:

- The facility for people from geographically distant sites to 'meet' without physically traveling to one location
- The asynchronous nature of communication (anytime, anywhere)
- Users can contribute to proceedings from any geographic location
- There is a permanent record of the group's work and of everyone's contribution to it
- Participants can access electronic resources and databases other than those used for the particular programme
- Social presence, process and product of CSCL meetings often differ from face-to-face meetings
- The opportunity to work cooperatively in groups is enhanced – CSCL technologies can support cooperative learning and group processes in ways that may be difficult to achieve in face-to-face meetings.

WFL meets all of the above criteria and therefore as an 'idea' technology can be classified as a CSCL system. As an 'idea' technology WFL extends the concept of the 'democratisation of educational exchange' (McConnell, 1994, p. 56) that excited many of the initial proponents of CSCL. It offers the possibility for what Boshier

(1990) identified as Habermas' 'ideal discourse', which should be 'open to other perspectives and points of view and accepting of others as equal participants' (McConnell, 1994, p. 56). If democratisation of educational exchange is predicated on the basis of equal participation by all stakeholders, then WFL can be regarded as a classic CSCL candidate by virtue of its original aims and intent, which according to a senior developer of the system was designed to bring about serious educational reform by:

- Transforming the rôle of the teacher from a "sage on a stage" to more of an educational coach by shifting more of the responsibility for learning to the student
- Involving the family, particularly parents, in education
- Expanding the educational process beyond the classroom to home, libraries, community centres or anywhere reachable by the Internet. Moreover Wired for Learning's database of teaching mentors enable teachers to find and engage extra help when and where it is needed.

Perhaps though the essence of Wired for Learning as an 'idea technology' is best expressed by Hall (1996) who had this to say:

"As an experiment WFL has the potential to illustrate how technology can bring about the reinvention of education by highlighting what happens when parents get involved in their children's' schoolwork, when students and teachers work together in teams, when standards are really used, and when students can extend their reach globally for the resources they need to learn" (p.6).

Conclusion

In this chapter I have discussed the background to the development of the Wired for Learning project in Ireland and the larger context of IBM's Reinventing Education programme within which this technology solution emerged. I have also outlined in detail the WFL technology platform and its affiliation with Lotus Notes, CSCW and CMC. Fundamentally the WFL project was designed to promote change in the Irish education system by using the WFL tool as a vehicle through which that change could be delivered. Chapters five and seven will examine in greater depth the

manner in which Wired for Learning was implemented in schools, its implications for teacher professional practices and how the school culture in a highly centralized education system reacted to its implicit change agenda.

Chapter Three

The Thin Client SIP Project

Introduction

The second SIP project to be researched for this dissertation is The Thin Client server solution project. This project aimed to explore the sustainability of an ICT infrastructure in Irish schools by setting up a network of thin client devices in a dedicated lab and in classrooms with access to the normal PC Windows desktop using Citrix Metaframe.

Thin Client Technology

Thin client is a network based server solution in which clients act as terminals providing access to applications and data held on servers. Regarded as the next step in the evolution of computers or the next generation of computing, thin client is based on the simple concept of centralising computing power, storage and data on the server while providing users with an inexpensive client device (i.e. terminal) that is easy to install and maintain. Effectively a cross between a mainframe and PC, thin client technology combines the ease of use and GUI interface of the desktop platform with the security, housekeeping and administrative benefits of a server based system.

In the thin client environment the client connects to the server through the network to run applications, access files, print and perform services available to standard desktop computers. In this respect it differs markedly from a standard network where 'fat clients' i.e. desktop computers perform most of the application processing in addition to storing application software and data on their own hard disks. Typically in a 'fat client' network, a component of a shared program such as Word, Excel etc., will reside on the PC and a component will reside on the server. When the user invokes the application, it loads into the PC memory and executes. From that point on the PC only uses the server as remote storage and requires no server processing for the application to run (Sinclair & Merkow, 2000).

Beyond Mainframes and PC's

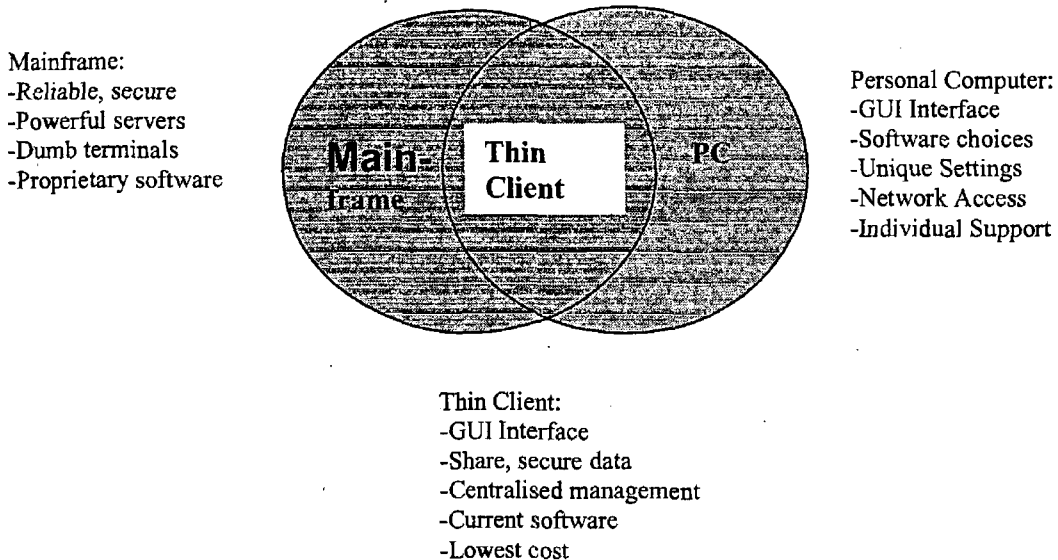


Figure 10: Source: <http://www.national.com/appinfo/thinclient>

The origins of Thin Client technology can be traced back to the Network Computer (NC) idea, generally attributed to Larry Ellison of Oracle, and a small company called Citrix Systems, who invented a way of using Windows programming over networks without straining the network and without the need for windows operating system on the client computer. Thin client is effectively the fusion of these two developments with the NC concept representing the hardware component and the Citrix software representing the software component.

The Thin Client Environment

The four essential components of the thin client environment are:

- **An application Server**
- **Software**
- **A network infrastructure**
- **Thin client devices**

The Server and Software

The **application server** is a robust and powerful computer capable of supporting all clients and their application requirements. Generally it requires two pieces of **software: Microsoft Windows NT server 4.x – Terminal Server Edition or Terminal Services in Windows 2000, and Citrix Metaframe**, using the thin-client protocol based on Independent Computing Architecture (ICA). The Citrix Metaframe software, also referred to as the Citrix client or ICA client, is an adaptation of X Windows technology, which facilitated the development of cross platform application computing. It is the Citrix software which allows for a variety of proprietary platforms such as Macintosh, Unix, and Java to be supported in the thin client environment. It also provides the Windows operating interface on thin clients via the TCP/IP protocol to use the Windows operating system and Windows applications software remotely. It should be pointed out that if you do not need to support proprietary computers, there is no need to install the Citrix Metaframe software. This is because Microsoft has now incorporated a modified version of Citrix software into its latest edition of Windows NT and into Windows 2000. However this configuration will support Windows based terminals only. If you want to use other operating platforms you have to run Citrix Metaframe software together with Windows NT Terminal Server or Windows 2000. Metaframe is the latest version of the Citrix software, which when first introduced was known as Winframe.

The Network Infrastructure

The network infrastructure is the pipeline between the server and the client, which is usually a standard Ethernet connection or telephone network. The bandwidth required by thin clients is less than that needed by traditional PC's or 'fat clients'. This is because thin clients only transfer mouse clicks, keystrokes and screen images between the server and the client unlike PC's that download program files and data files from the network.

According to Citrix, (<http://www.mcc.ac.uk/Thin.gothin.htm>) applications run on a server and displayed via ICA can consume as little as 10% of the network bandwidth they would require running on the client but loaded from a network file server. This has obvious attractions when information needs to be transmitted to remote locations over telephone lines. A pilot study of thin client technology conducted at the University of Manchester (Cupid, 1999) concluded that the “solution runs acceptably over a 28.8k modem or better” (p.3). A similar study at the University of Bristol (Buttner, 1999) expressed satisfaction at modem rates as low as 14.4kb.

Server-centric Computing

- Centralized hardware upgrades
- Centralized software upgrades
- Centralized maintenance

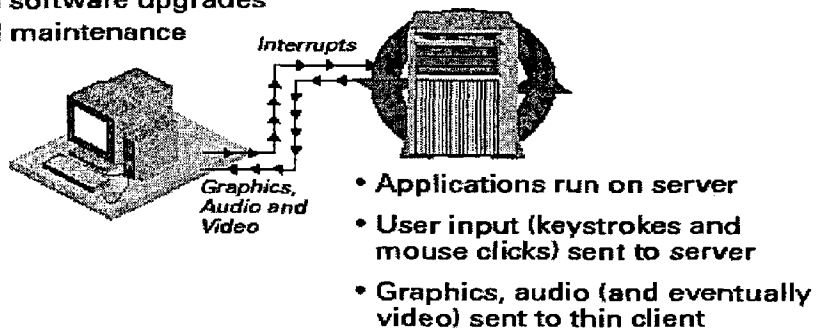


Figure 11: Source: <http://www.national.com/appinfo/thinclient>

Thin Client Devices

Thin Client devices come in two types:

- Network Computers (NCs) and
- Windows-based terminals (WBT).

The NC or ‘native’ device as it is sometimes called, is a terminal optimised for use in a server based computing environment. As originally conceived by Larry Ellison of Oracle, the NC is “premised in the idea that it should be able to do anything a normal networked PC can do except provide its own programming and storage”

(Sinclair & Merkow, 2000, p.43). The NC is physically much smaller than a typical PC, approximately the size of a small VCR, although in some cases they can be as small as an external modem. Because the NC downloads the programming from the server as needed by the user, the sealed thin NC case contains no moving parts, no drives, CD-ROM, modem or other accessories. Hence the term 'thin'. The only components contained within an NC device are a microprocessor with graphics capabilities, a network interface, a video subsystem and enough memory to connect to the server – usually between 8 –16MB, although a more reasonable minimum configuration to cover a wide range of application options would probably be 32MB. The NC starts up with a very basic operating system from a chip inside the NC and then gets everything else it requires from the Network Server. The NC has a longer shelf life than a standard desktop computer, estimated at between 7- 10 years as opposed to 3-5 years for a desktop PC (www.national.com/appinfo/thinclient) It is also more energy efficient, consuming 1/6 of the watts per hour required by a PC. Other benefits include:

- Improved cost effectiveness as it does not need a hard disk or require much RAM
- Greater robustness and durability as it contain fewer moveable parts
- Less troubleshooting and maintenance
- Reduced risk of virus infections

Most software and web enabled applications will run on thin clients devices although some multimedia rich applications can be problematic especially when the number of concurrent users is high.

According to industry reports (www.national.com/appinfo/thinclient), windows based terminal (WBT) are the fastest growing segment of the thin client market. Described as the PC industry's thin client alternative to the NC (Sinclair & Merkow, 2000), windows based terminals evolved from the NetPC. The NetPC was Intel's and Microsoft's response to the threat to their desktop dominance, posed by Oracle's original NC. The NetPC was designed to reduce the cost of business computing by

scaling down the traditional PC box and facilitating businesses to centrally manage their information technology requirements.

One of the advantages of WBT's is that they utilise existing network infrastructures, equipment and software already in place. To the end user they look and behave much like a standard PC except they have no floppy drives or expansion slots. Like NC's they use a sealed case design so users cannot add or upgrade software onto them and they support centralized administrative management. Unlike an NC however, a WBT contains an internal hard drive, which reduces their dependence on the network for programming resources and permits a certain degree of user control over file storage. The big advantage of this arrangement is that if the server or the network goes down, they can continue to operate on limited basis. An NC however is useless without a server connection.

**Thin Client
Device**

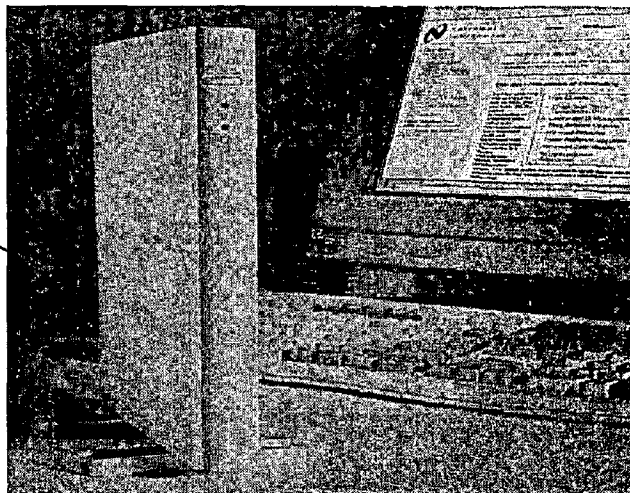


Figure 12: Source: <http://www.national.com/appinfo/thinclient>

Although NC's and WBT's represent state of the art thin client devices, technically speaking any user device connected to the server via the thin client protocol can also be called a thin client. This means that a standard computer can function in a dual capacity as both a PC in stand alone mode and as a thin client when the users logs on to the thin client network. This is particularly useful when an organization has older or 'legacy' computers, as they are sometimes called such as 386's, 486's, Mac's etc. By incorporating these devices into a thin client network using the thin client protocol, legacy computers can be configured to deliver the same software functionality as more up to date computers on the network. This in turn can help to

reduce the redundancy factor and obsolescence overheads associated with older computers.

Total Cost of Ownership (TCO)

Although still a relatively new technology, the thin client platform is arousing much interest in industry, large organisations and third level institutions, not least because of its promise of lower cost computing. As technology budgets have skyrocketed, organisations have become much more sensitive to the total cost of technology ownership.

The measure of the lifetime cost of a piece of technology is its **Total Cost of Ownership or TCO**. Management, systems support and downtime are the fastest growing and least manageable costs to owning technology (www.national.com/appinfo/thinclient). Traditionally, TCO was expressed in simple terms and only accounted for the cost of owning and maintaining desktop hardware in the organisation. It neglected to take into account the cost of purchasing, supporting and maintaining the associated software - a substantial cost in its own right. A more sophisticated TCO model developed by the Gartner Group includes not only the hardware but also the software and all the ancillary elements including hidden costs such as downtime, lost productivity and user self help, required to deliver software applications. The accompanying diagram shows the Gartner's group estimates of the real PC costs that are incurred after purchase.

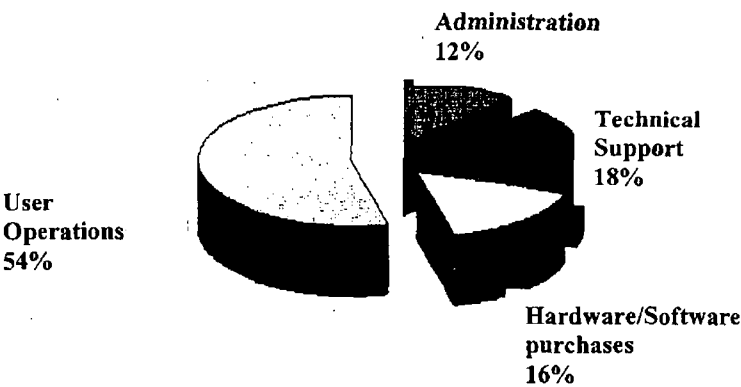


Figure 13: Gartner Group Support Cost estimates: Source: Thin Client Clearly Explained

By using the Gartner Group TCO model, a more accurate picture emerges of the true cost of technology deployment in organisations. Consequently it is easier to determine how savings can be achieved throughout the entire application ownership cycle from purchasing, deployment, operation and support to actual use (<http://www.citrix.com/education/primary>). The Tolly group (1999) maintains that the greatest TCO savings occur when an organisation deploys an application server solution and according to Zona Research, system administration cost savings as high as 54-57 percent can be achieved over a five year period using a thin client solution versus a traditional computing approach (www.national.com/appinfo/thinclient).

Zona Research studied the 5-year cost of 15 Windows PCs with an NT server and compared it with the cost of 15 Wyse WinTerm clients with an NT/Winframe server. The PCs cost more than twice as much to maintain at a little over \$200,000 (Sinclair & Merkow, 2000, P.428). National Semiconductor, a Fortune 500 company estimates that it has reduced its TCO from \$7,600 per client desktop to \$3,250 per client through the use of thin client technology, thereby saving the company more than \$30 million per year. IBM has stated that annual savings from 25% to 75% can be realized by using NC's instead of PC's (Sinclair & Merkow, 2000, p. 55). Not surprisingly then, any technology solution which will improve the bottom line by helping to lower TCO will be favorably regarded by business. Thin Client is one such solution.

In addition to cost savings, much of the allure behind thin client technology is that it makes the difficult tasks of managing a company's desktop computers easier. Clearly the cost and difficulty of maintaining fat client technology call for administrative simplifications, so much so that Roy Shulte, VP of system software technologies at Gartner, predicts that within 10 years, 30-40% of desktops will be thin clients relying on some type of Network Computing Architecture (NCA) (Sinclair & Merkow, 2000, p.429.)

Technology, Schools and Thin Client

Given that thin client is a relatively new technology and that it is still only in its infancy in terms of market penetration in the business arena, it is probably true to

say that very few schools have up till now even heard of thin client, let alone considered it as an option or sought to deploy it. There are some exceptions however and currently there is a pocketful of schools around the world in places like Australia, America, Norway, the UK and Ireland that are using the Thin Client platform. Anecdotal evidence would suggest that such schools and the administrations that support them are in the vanguard of educational technology.

Affordable Device, Portable Information

	Thin Client	PCs	Laptops
Purchase cost	\$500/device	\$1,000/device	\$1,800/device
TCO/year	\$2,500-5,000	\$7,000-10,000	\$10,000-13,800
Applications & information	Secure, updated, central control	Some control, not secure	No Control
Long-term	Add devices	Upgrade	Replace
Less power	7-10 watts/hour	45 watts/hour	
Durable	No moving parts 300,000 hours MTBF	Fans, drives 20,000-40,000 MTBF	Fragile equipment
Access everywhere	Lots of devices, one log-in	Some devices, many log-ins	2-8 pound machines

MTBF=Mean Time Between Failure Rate

Figure 14: Source: <http://www.national.com/appinfo/thinclient>

Thin client technology offers a number of advantages for schools in the areas of

- **Costs**
- **Legacy Computers**
- **System Administration/Housekeeping**
- **Security and Reliability**
- **Space**

Costs

As a result of the huge drive internationally to computerise schools during the last decade, the number of computers in schools has increased at an exponential rate. In the US for example, the average ratio of computers to student in 1999 was 1:6 – down from 1:19 in 1992 (<http://www.citrix.com/education/primary>) and by 2000, 95 percent of all public school in the US had Internet access. (US Department of Education, National Center for education Statistics, Feb. 2000, cited in www.national.com/appinfo/thinclient). A similar pattern is evident elsewhere. According to the OECD, by 1998 Finland, New Zealand and Sweden had a ratio of 1 computer for 7 pupils or fewer at secondary level and 1:13 or fewer in primary. In the UK, Denmark, Ireland and Norway that figures was 1:10 or fewer at secondary and 1:20 or fewer at primary level. In the space of a single year alone, Ireland halved the number of students per computer from 1:37 in primary school in 1997 to 1:18 in 1998 and from 1:16 to 1:8 in secondary school during the same period. (OECD Education Policy analysis 1999)

There are significant costs associated with this level of computersiation in primary and secondary schools. During the 1999-2000 school year alone U.S. expenditures were estimated at \$5.7 billion (<http://www.citrix.com/education/primary>). As access has expanded and will continue to expand, schools like businesses will need to examine the cost implications of providing, maintaining and updating computer systems in a cost effective and efficient manner.

Evidence from the US suggests that most schools budgets only address the actual hardware and software costs which in effect account for only about 25% of the actual lifetime cost of technology, as most organizations spend 75% of their technology budgets after the initial hardware acquisition. In other words schools are following the traditional TCO model which business initially adopted in the early days of computerisation and are only factoring in parts of the cost of technology into their budgets. As a result, the Consortium for Schools Networking Project (2001) maintains that most school technology budgets are not yet reflecting the real costs of technology over a 5-year period. According to Microsoft, one of the

consortium members, a more accurate breakdown of the real costs for providing technology in schools emerges by adopting the Gartner Group's model of how to measure TCO.

In this context as more and more schools come to terms with the true cost of technology ownership and look for ways of controlling these costs, the thin client solution may prove an attractive option. Not only are NC's cheaper to buy, [although that difference has now become marginal as the price of desktops have fallen], they also require less maintenance and management, which in turn help to reduce many of the 'hidden' costs typically associated with school computing.

School Technology District Costs

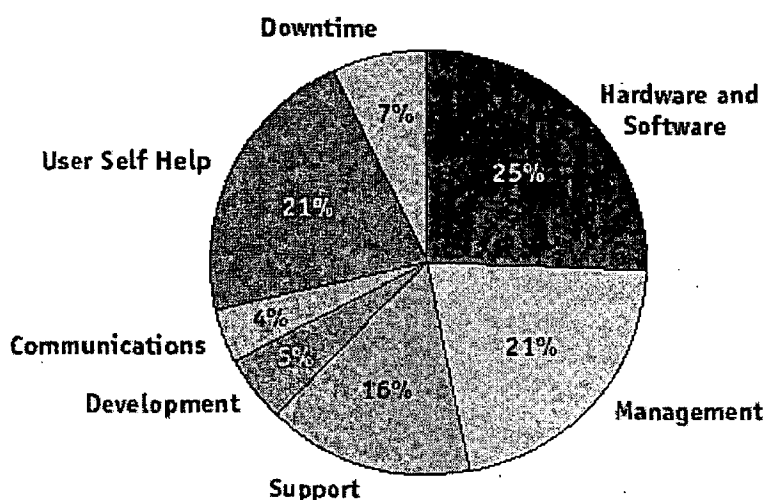


Figure: 15: Source: http://www.microsoft.com/education/implement/tco/h_page2.asp

Legacy Computers

Another attractive feature of thin client technology, particularly for schools, is that outdated equipment i.e. legacy computers such as Apple's, 386 and 486 machines can be configured to function on the thin client network, thereby extending the useful life of older equipment and providing access to up-to-date software which would otherwise require hardware upgrades of each client. For a legacy PC, a

minimal installation of DOS, network client software and the Citrix ICA client software is all that is required for the system to act as a thin client (Buttner, 1999). Because most thin client solutions include emulators, the latest and most up to date application software can be seamlessly delivered to the end user, irrespective of the age of the machine and without the need for expensive memory and hard drive upgrades. According to the University of Bristol, “by reusing legacy machines as thin clients to equip computer rooms, savings approaching 50% of capital costs (compared to all new equipment) are potentially obtainable” (p.1). The critical point at which cost savings kick in is at 10 or more clients. Apart from the obvious cost saving benefits, extending the useful shelf life of existing computers can also help to improve the student computer ratio in schools.

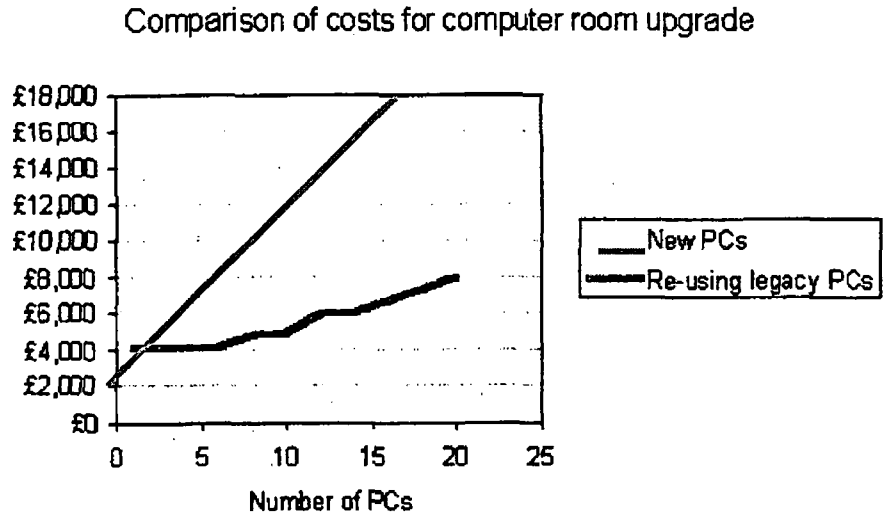


Figure 16: Source: JISC Report 31

System Administration/Housekeeping

Because thin clients have a single point of administration at the sever, the time and cost associated with administrative and housekeeping tasks are reduced. The system administrator updates and maintains the clients by managing the server. This means that new applications and upgrades need to be loaded only once onto the server from where they become instantly available to all devices on the network, irrespective of age or hardware configuration. Unlike a traditional network there is no need to load

applications onto individual machines. This makes the hosting and upgrading of software applications easier to manage. Furthermore the centralised distribution of software helps to eliminate the problem of version control and the time required to track software licenses loaded onto individual machines, not to mention conflict errors and other time consuming housekeeping tasks. Thus the “real savings in support effort become obvious when application software needs to be updated. Rolling out a new application to a room full of PC’s can be tedious: on a Terminal Server, install it once and the task is complete” (Buttner, 1999, p. 17).

Effectively this means as industry case studies have borne out that thin client networks require fewer staff to manage more machines, which in turn significantly reduces TCO (<http://www.citrix.com/education/primary>). It may be argued that because schools employ less support staff per computer user, 1 for every 500 in K12 schools as opposed to 1 for every 50-75 in business, (Consortium for schools networking presentation, 2001), that cost savings in this arena may not be that significant for schools. As against this however it should be remembered that because schools rely heavily on teachers for tech support, the apparent budget savings flatter to deceive. As the Schools networking consortium argues the cost of tech support may be low but may also be inadequate and it is certainly not cheap if teachers are filling the gap (http://www.cosn.org/tco/project_pubs.html).

Security and Reliability

Because all data is stored on the server, the risk of data loss is greatly reduced, as servers unlike individual PC’s are backed up regularly. If a thin client fails or is stolen, none of its data is lost. Placing the server or servers in a locked room with limited access can further enhance security. Furthermore because information is available from any device, there is no need to use floppy disks to move files, which in turn reduces the risk of virus infection. Native thin client devices add even more reliability to the system as they contain fewer moving parts that can break down and users cannot change settings or install conflicting applications. An NC will function longer than a standard computer without failing, clocking up an average of 300,000 MBTF hours (mean time between failure rate) compared to 20,000 – 40,000 for a PC (www.national.com/appinfo/thinclient/thinVsFat.html).

Space and Ergonomics

Where space is at a premium, as is the case for many schools where retrofitting is required, NC's by virtue of their slim build will require less physical lab space than a standard PC configuration. They also make efficient use of limited classroom space, which in turn means that more computers can be deployed in the classroom, thus helping to support the goals of ICT integration by increasing the amount of classroom access. Because NC's contain only one processor, they do not generate the same level of heat as PC's and therefore they require no fans. With no added heat, no noisy fans and no moving parts, the ergonomic environment of the classroom and the lab is greatly improved, a factor which is likely to take on greater significance in the future, as computer ergonomics warrants greater attention in health and safety legislation.

Limitations

Like every technology Thin Client has its downsides. From the educational market perspective its key limitations include the following:

- **Network Robustness**
- **Reduced multimedia capabilities and software constraints**
- **Network Management**

Network Robustness

The reliability of both the network infrastructure and the server are critical in a thin client environment. Networks are by nature complicated and thin clients complicate them further by virtue of the demands that they continually put on the network. Thin clients potentially create more traffic for the network to manage. Any network inefficiency or slowness is immediately apparent in this environment as it is less fault tolerant than a standard network. Consequently the productivity of all users will be affected. If the sever goes down nothing will work unlike a PC network where users can still access any applications any data stored on their desktop even if they loose access to the network. In this context schools are particularly vulnerable

as they are unlikely to invest in a back up sever with the attendant costs of both hardware and technical expertise to support it.

Reduced Multimedia Capabilities & Software Constraints

Some multimedia rich applications either will not run or will run very slowly over a thin client network. This is particularly the case where applications make heavy demands upon memory or CPU power or both and the number of concurrent users trying to access the application is high. Graphic intensive packages such as CAD/CAM (Computer Aided Design), GIS (Geographic information systems) and powerful statistics packages and applications that require a large number of simultaneously displayable colours tend to perform poorly in this environment. Dongle protected software, a feature of many multimedia content creation applications cannot be supported, as they need to access machine hardware directly. Some educational CD-ROM's have been coded in such a way that they too need to access the local hard drive in order to function. Furthermore, as many of these CD-ROMs do not utilise the more efficient streaming audio and video protocols that have become standard on the web, it is very easy to clog up a thin client network with large audio and video files.

However it should be pointed out that many of the above limitations are not insurmountable and that as thin client technology matures and achieves market penetration these problems will be sorted out. As more and more software companies web enable or optimize their graphic intensive educational software for network use, they will soon work well on thin clients. The development of SMIL, (Simultaneous Multimedia Integration Language) which reduces the amount of memory required to run multimedia, should also be good news for the multimedia functionality of Thin Clients. The key point for educators planning to introduce a thin client network is to be aware of these limitations and to plan accordingly.

Network Management

Installing and maintaining a thin client network demands a high level of technical expertise, especially at the system administration and server maintenance levels. As this is a server centric environment, where all workstations depend on the server

functioning at its optimum, the system administrator needs to be very pro-active in monitoring its performance and warding off potential problems before they escalate. It is important to ensure that fixes are applied as quickly as possible when security loopholes are discovered. Administrators also have to plan for network upgrades from hubs and routers to LAN switches to avoid degradation of service to thin client users. In general administering a thin client environment requires a great deal of up-front planning and analysis. Adequate resources need to be committed to such efforts. Not every school will have this level of technical expertise available on staff and therefore the installation of a thin client platform may not be the wisest of options in such circumstances.

A viable alternative however would be to use the services of an Application Server Provider (ASP) who would manage and maintain the server equipment and software applications and rent the software to schools based on an annual subscription fee per user. Another option is to create a server farm, which a large number of schools could share and thus avoid local maintenance problems by having all such work centralised where the server/s were located. This is the type of model, which the Lemon Grove School District (www.lgsd.k12.ca.us/lemonlink) in California deployed.

School District Network Using Thin Clients

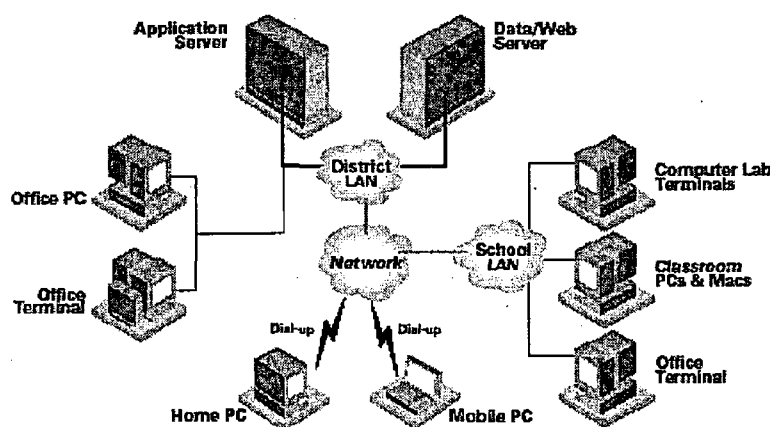


Figure 17: Source: www.lgsd.k12.ca.us/lemonlink

What Schools have to say

In schools that have adopted the thin client sever solution, significant cost savings on TCO have been recorded. In California, the Lemon Grove School District reduced its IT Support costs by 50% (<http://www.citrix.com/education/primary>) and the final figures show that that the district can purchase and support three client devices for the cost of one multimedia PC. The Waldbrook High School in Baltimore estimates that is saved approximately \$15,000 in networking expenses and \$45,000 in support costs by installing a thin client network.

In the UK, the Arthur Dye Primary School in Cheltenham saved 25% on the initial cost of the network, compared to a PC implementation and also achieved cost savings on software upgrades (Department of Education, Victoria, Australia, 1999).

According to another UK school:

"Thin Client technology is not necessarily the cheapest initial solution but it does bring major management benefits and, in time substantial savings when systems need upgrading" (Becta 2001a).

In Ireland the experience has also been positive. The IT Coordinator has this to say:

"the system has been in place for 21 months and during that time not a single penny nor minute of time has been required in maintenance on the 40 NCs. In fact I have not even seen some of these NCs since they were deployed in the classroom during the initial installation" (SIP 041 – The Thin Client Solution – Final Report, 2001, p. 24)

Following extensive testing on the suitability of thin client networking for schools conducted at the Thin Client Research and Development facility at the Department of Education in Victoria, Australia, the final report concluded that a "thin client solution in a school can be of great benefit and assist in achieving the ratio of 1 computer to 5 students at a lower current and future expenditure". It also concluded that a thin client network can reduce the cost of ownership in a school, minimise the

Administrator's workload and expand the use of Learning Technologies by reducing expenditure on new equipment.

The Thin Client Server Solution SIP Project

The aim of this Sip project was to explore the innovative use of an ICT infrastructure in an Irish school based on a Thin Client Network. The project involved the network cabling of the entire school building with two network points in each room, including ancillary rooms and PE hall. A classroom, which had become available due to falling numbers in the school, was converted into a computer lab and a section of the room was partitioned off to act as a server room.

Both the computer lab and server room were fitted out with specially designed computer benches and structured cabling for network and electrical points. A separate fuse box from the rest of the school was fitted for these rooms and located in the sever room. The school alarm system was extended and enhanced to cover the computer and server rooms fully. A special darkening and reflective film was applied to the glass on the computer room windows to help reduce glare and to enhance security.

The Thin Client network comprised 40 brand new NC's, a large powerful sever and some older 486 PC's. The 486 machines were configured with a basic installation of Windows 95 and the Citrix ICA client software and these were distributed to the principal, the library and the administrative office. This enabled them to log onto the sever to run Office 2000 as well as browse the web.

Twelve of the NC's were deployed in the classrooms while the remaining 28 were installed in the new computer laboratory. The lab also included two fully blown multimedia PC's one with a scanner attached and the other with a hook -up for use with a digital camera. One of the project sponsors, a local company called Technico, who were also installing the sever for the system, donated a Data Projector for the lab. A network laser printer that also functioned as a digital photocopier was located in the main lab. A second printer, a high-speed colour inject was installed in the sever room for use by teachers only.

The sever, which was housed in a secure annex off the main lab, was a Dell PowerEdge 4300 Pentium 450 server. It was specified with a RAID 5 system of hard discs, which protected data against loss in the event of a normal failure of the hard disk. The server also contained 1 Gigabyte of RAM, enough to support 40 clients logging in at the one time. The Sever was installed and configured with Windows NT4 Terminal Sever edition and Citrix Metaframe to allow the NC's login and run a session using Windows NT4. A large Comms cabinet was placed in the server room to house the Patch Panels, where each of the schools network cables terminated. Internet access was catered for by a Networks CX box connected to the school's ISDN line that was located in the server room. To allow for fast access to CD-ROMs a CD Serve box was fitted to the network and this facilitated access to as many as 28 full CD's to anyone on the network.

The Thin Client devices were Acorn NC's. This enabled them to run all the Acorn software which the school had already invested in as a result of its previous involvement with educational computing, which in the case of this school, went back to 1988 when the school bought its first computer. This configuration meant that teachers had access to all the Acorn software with which they were already familiar and also to more up to date PC specific software.

The operation of this dual system was simple. When the teachers logged onto the system initially, the default screen brought them into the Acorn environment from where they could run the acorn software. When they wanted to access the PC side of the system, they simply had to double click on the Ntserver icon on the top left corner of the Acorn desktop screen. On doing this a logon screen appeared into which the user typed his/her Username and Password. This then brought up the standard windows desktop environment from where PC specific packages could be run by pressing the "Start" button.

Summary

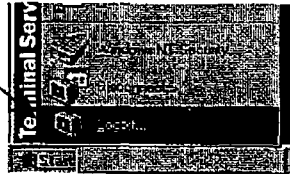
It took 3 months to get the thin client sever solution up and running. The project was approved for funding under the SIP project initiative at the end of March 1999. The system was fully in place and ready to accommodate the delivery of a computer course for teachers in the new facility by the first week in July 1999. As this was the summer period, the use of the system on a school wide basis could not be tested until the next academic year commencing September 1999. It was during this academic year that my research on this project took place and a more detailed case study portrayal of the project, the school context and ICT development will be presented in chapter six. Chapter seven will compare and contrast the experiences of the Thin client school and the Wired for Learning schools in terms of how their respective projects were implemented, supported and managed.

Usage of NC System

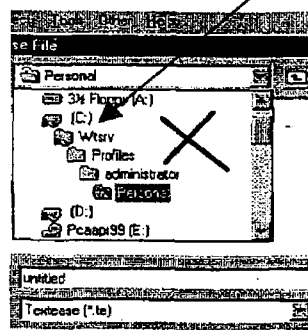
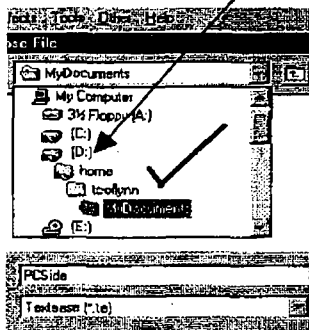
PC Side: Each person using the PC side of our System is actually running software on the main server in the server room and not locally on the NC.

Double Click the NTServer Icon on the top left of the Acorn Desktop (screen) and then enter your Username and Password.

When finished it is important to Logoff using that option found by clicking on the start button. **Do not** use the Disconnect option.



Each person using the PC side has a personal profile (E-Mail settings etc) that is stored on Drive C. Some of the software packages will bring you to this area automatically when you go to save your work. **You must not** use this as your storage area. All your work should be saved in your "Home" folder on Drive D instead



You should organize a set of sub folders in your main "MyDocuments" folder to suit your own requirements.

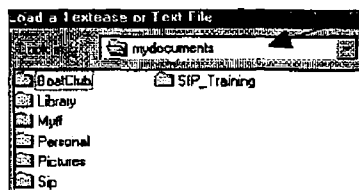
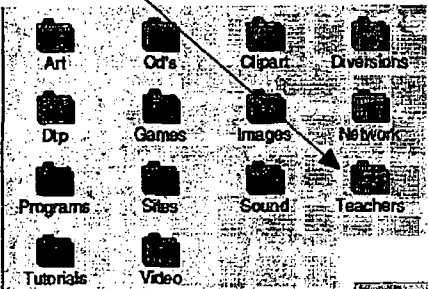


Figure 18: Thin Client Server Solution Project illustrating main desktop configuration

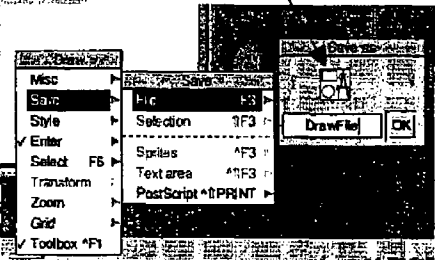
Usage of NC System

Acorn Side: Operating System is as before with all software stored on the Server Hard Disc.

Save your work or children's work to your Teacher's folder as below: Remember to open your folder first.



Save by naming the file and dragging and dropping the icon into the open folder.



Print - Try the Print Key or else find the Print option on the Menu. (middle button of mouse).

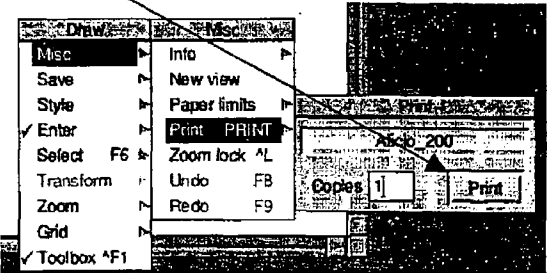


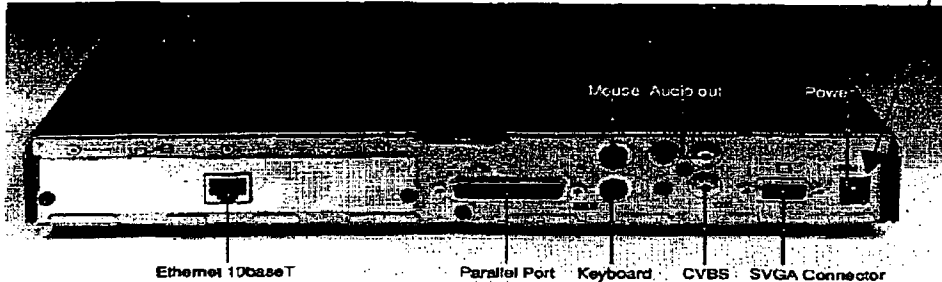
Figure 19: Thin Client Server Solution Project illustrating Acorn side of System

Tips:

If the Program crashes (locks up) try ALT + BREAK simultaneously.

If this fails try resetting the computer with CTRL + BREAK

If this fails try resetting the computer by unplugging the Power lead (back left corner of the NC).



Irish Writing: To give a vowel a FADA press ALT + [(square bracket) followed by the vowel you wish, eg á é í ó ú.

To move from the Acorn side of the NC to the PC side you must double click on the NTServer Icon on the top left corner of your screen.



When presented with the Logon Screen Type in your Username on the first line and your Password on the following line and then press RETURN key. This will allow you to access the PC side of the system.

Chapter Four

Methodology and Research Design

Introduction

This purpose of this chapter is to describe the methodology and the research approach which shaped this study in order to explain how the research process was designed conducted and managed. The chapter is made up of three sections. The first section examines the nature of the qualitative research paradigm that underpins this study. The second section discusses case study research, the methodology that framed this work. The third section describes the data gathering tools and methods used in both the collection and analysis of data for this study.

Section One: The Qualitative Paradigm

Both the choice of topic and the research paradigm influence the design of a research study. A paradigm is basically the conceptual framework comprising beliefs, values and methods within which research takes place. The two major paradigms in educational research discourse known as the 'quantitative' and 'qualitative' paradigms reflect different ways of looking at the world (philosophy) and the nature of knowledge i.e. what can be known (ontology) and how it can be known (epistemology).

The quantitative and qualitative paradigms differ in their philosophic assumptions about the nature of reality and the construction of knowledge and hence they adopt different research perspectives and techniques. The philosophical outlook associated with the quantitative paradigm, also known as the 'scientific' or 'empiricist' paradigm is positivism. Positivism is highly influenced by the research perspective of the natural sciences that defines knowledge in terms of observable facts, which can be objectively verified by looking, testing and measuring. In this research tradition reality is understood as an objective phenomena, independent of the researcher, which can be objectively measured using standard scientific research

criteria based on objectivity, measurement, prediction, proof and control. Consequently quantitative research tools such as experiments and surveys with their emphasis on numbers, control, measurement and proof, dominate quantitative inquiry.

In contrast, the philosophical outlook associated with the qualitative paradigm, also known as the 'interpretive', 'naturalistic', or 'postpositivist' paradigm is phenomenology. Phenomenology is best understood as a style of philosophising which attempts to get to the truth of matters by describing phenomena as it manifests itself to the consciousness of the experiencer. For phenomenologists, explanations cannot be imposed before the phenomena have been understood from within. In essence then phenomenology focuses on understanding how individuals interpret their own experiences. Researchers using the phenomenological approach are concerned about how individuals and groups perceive their worlds (Stevens et al., 1993) and therefore 'multiple realities' rather than a single reality need to be taken into consideration.

From this research perspective reality becomes a 'subjective' rather than an 'objective' phenomena and the aim of research becomes one of understanding, insight and empathetic interpretation of that reality. To achieve this the researcher needs to interact with those they study which means that the researcher is no longer independent from that being researched. Hence the researcher becomes the main research instrument, as the scientific techniques used to investigate natural phenomena are no longer seen as applicable to the study of social phenomena. Consequently qualitative research tools such as in-depth interviewing and observations i.e. people's words and actions which help us to understand people's experience in context, dominate qualitative inquiry. The phenomenological approach to qualitative inquiry is probably best summed up by Patton (2002) who had this to say:

"Phenomenological approaches focus on exploring how human beings make sense of experience and transform experience into consciousness, both individually and as shared meaning. This requires methodologically, carefully, and thoroughly capturing and describing how people experience

some phenomenon – how they perceive it, describe it, feel about it, judge it, remember it, make sense of it, and talk about it with others. To gather such data, one must undertake in-depth interviews with people who have directly experienced the phenomenon of interest; that is, they have “lived experience” as opposed to second-hand experience”. (p.104)

Conducting Qualitative Research

One of the hallmarks of qualitative research is that it is conducted in a natural setting. The natural setting is the place where the researcher is most likely to discover, or uncover, what is to be known about the phenomenon of interest (Maykut & Morehouse, 1994). Through prolonged engagement in the field of study, the researcher comes to understand the experience of people in context. This understanding forms the basis of what Cresswell (1994) calls ‘indwelling’ or being at one with the persons being studied. To indwell effectively the researcher must be capable of not just entering another’s experience but also of reflecting on it. It is through this process of being ‘a part of and apart from’ (Patton 1980), that the researcher comes to understand the person or phenomenon under investigation.

Because qualitative research aims to understand the world as experienced by others, people’s words and actions are central to the research process. What people say and do reflect the essence of how people interpret their world. Faced with the task of capturing peoples’ interpretations the qualitative researcher relies on two kinds of qualitative data collection techniques, human to human and artifactual (Lincoln 1992). The former refers to data gathering techniques such as interviewing and observations while the latter refers to the examination and analysis of documentation such as reports, minutes and memos and other artifacts such as videotapes, photographs etc.

Qualitative research is characterised by its flexibility and most qualitative research studies have an exploratory and descriptive focus. Thus the concept of ‘emergent design’ is central to an understanding of the research process. Until the researcher enters the world of the participants it is impossible to know in advance precisely what the focus of the study should be, although the researcher may have ‘hunches’

based on a tacit understanding of the issues to be investigated. In this sense the design of a qualitative study is not determined in advance but rather evolves as the concerns or 'emic issues' of the study's participants emerge and shape the research design and analysis as data is collected, refined and reflected on.

The concept of emergent design is also mirrored in the sampling techniques and procedures used in qualitative research. As qualitative researchers are primarily interested in gaining a deep understanding of the phenomenon under investigation as experienced by participants, qualitative researchers use 'purposive sampling' rather than probability sampling techniques. In purposive sampling, cases or people are handpicked for inclusion in the study on the basis of how they will best illuminate the phenomenon being studied. An in-depth study of these information rich cases enables the researcher to discover the heterogeneous patterns and problems that occur in the particular context under study (Erlandson et al., 1993). In purposive sampling researchers adopt different sampling strategies when it comes to selecting information rich cases or informants including typical case sampling, extreme case sampling and minimum case sampling (Patton 1990). Lincoln and Guba (1985), among others, advocate a technique known as maximum variation sampling. According to Maykut & Moorehouse (1994), this latter technique in which the researcher seeks out participants and settings that represent the greatest differences in the phenomenon being studied, in order to understand the phenomenon most fully, is one of the most widely used and useful strategies.

Just as qualitative and quantitative researchers use different sampling techniques for gathering data, they also use different techniques for analysing that data. In keeping with the emergent design concept, qualitative researchers adopt an inductive approach to data analysis. Through a detailed and rigorous process of examining and analysing the meanings of people's words and actions, the research findings emerge from the data through a process of inductive reasoning. In qualitative research, analysis is an ongoing process as the researcher critically reflects on the meaning of events as they unfold in the course of the study.

Making sense of the data can be a lonely and time consuming task. It can also be quite a challenging task as unlike quantitative research there is no set format for analysing and presenting the data. In qualitative research the task of collecting and analysing data is a creative process where much depends on the researcher's ability to weave a credible narrative in which both the participants voices and researcher's reflective indwelling can be heard and ultimately expressed through the research story. In composing this story, qualitative researchers inevitably face the daunting question "Am I getting it right?" In other words "is this account credible?".

These questions go right through to the heart of the research process and are intimately linked to the concepts of 'authenticity' and 'trustworthiness', which shape and inform the research design and analysis. For qualitative researchers these concepts determine the quality of a qualitative study in the same way that the concepts of reliability and validity determine the quality of a quantitative study. The basic rule is that the more authentic and trustworthy the account, the greater the confidence in the research findings. Lincoln & Guba (1985), and Elanderson et al. (1993), outline several techniques for researchers to adopt, in order to ensure the trustworthiness of the research design and process. Four of these in particular are worthy of special mention. These are:

- **Triangulation**
- **Prolonged Engagement**
- **Thick Description**
- **Audit Trail**

Triangulation

Triangulation is a term taken from geometry and survey engineering which literally means looking at the same thing from different angles. In qualitative research triangulation is used as a technique for building confidence in the research findings. According to Cohen and Manion's (2000) definition, triangulation is the use of two or more methods of data collection in the study of some aspect of human behaviour.

In qualitative research triangulation serves two functions. At the methodological level, it plays a very important role in establishing the truth-value or validity of the research findings. It can also be used as a design technique that allows the researcher to explore more fully the 'multiple realities' that exist within the context of a study.

Triangulation can take many forms. Denzin (1989) identified six different types, of which methodological triangulation is probably the most useful and widely used type. He also distinguishes between two categories of methodological triangulation known as "within-method triangulation" (Interview A, Interview B, Interview C) or "between-method triangulation." The latter which uses a combination of different research tools such as interviews, observations, surveys and documents in order to establish a level of convergence between different data sources, is regarded as the more robust form. The greater the convergence established throughout the triangulation process, the greater the confidence in the findings and hence their validity.

Prolonged Engagement

Prolonged engagement adds to the trustworthiness of the research process by enhancing the scope of a study. Prolonged engagement is about the researcher spending enough time on the case to become immersed in issues and gain the trust of the participants in order to overcome distortions or biases. Enough time does not necessarily mean 'going native'. It does however mean that the researcher must spend sufficient time in the culture or context so that she or he can understand the day to day reality in the same way that members of the culture interpret it.

Thick Description

The use of 'thick description' adds discipline and rigour to qualitative analysis. Thick description illuminates the context under study and allows the reader to enter into the environment and into the life of the culture as portrayed in the thoughts of the people who live there. As Denzin (1989) reminds us:

"A thick description does more than record what a person is doing. It goes beyond mere fact and surface appearances. It presents context, emotion, and the webs of social relationships that join persons to one another..... It establishes the significance of an experience, or the sequence of events, for the person or persons in question. In thick description, the voices, feelings, actions, and meanings of interacting individuals are heard". (p. 430)

Denzin goes on to explain that thick description sets up and makes interpretation possible because "it contains the necessary ingredients for thick interpretation". The researcher's task in qualitative enquiry is to balance description and analysis in such a way as to establish meaningful and useful interpretation. Thick description enables others reading the results to understand and draw their own conclusions.

According to Lincoln and Guba (2000), "thick description" also facilitates "transferability across contexts" (p.39) which is equivalent to yet markedly different from the concept of 'generalisation' in quantitative research. They argue that transferability depends on the degree of fitness between two different contexts which can only be determined by a researcher wishing to apply the findings from one research study [the sending environment] to another setting [the receiving environment]. This means that the onus to establish 'transferability' lies not with the original researcher but with subsequent researchers wishing to apply the study's findings elsewhere. However in order for this to happen the original researcher must "provide sufficient information about the context in which an inquiry is carried out so that anyone else interested in transferability has a base of information appropriate to that judgement. We shall call that appropriate base of information a 'thick description'" (p. 40). Thus thick description facilitates transferability by describing in detail the context and culture in which the study occurred.

Audit Trail

The idea behind an 'audit trail' is that the researcher should maintain a systematic record of the research data and research process so that the credibility of what transpired and the conclusions generated can be made more transparent and open to public scrutiny. Matthew, Huberman and Miles (1994) identify three audiences for

the audit trail. The first is the 'self' in other words the researcher, for whom an audit trail serves as a method of keeping track of what was done and guiding what else needs to be done. By keeping good records the researcher's own confidence in the research findings are enhanced. The second audience is the readers of the research report who need to know what was done and why, so that they can assess the credibility of the findings. The third audience is other researchers who may want to replicate the findings to other settings or do a secondary analysis of the data. Building and maintaining an audit trail is equivalent to what Stenhouse (1988), calls the 'case record' which he defines as the substantial collection of documents, observer's notes, interviews transcripts, statistics, and the like, which forms the basis of a case report.

Conclusion

In this section I have discussed the qualitative paradigm and discussed some key areas where it differs from the quantitative paradigm to illustrate how these differences shape the research perspective and methods of researchers operating within these two traditions. I have also outlined the process of conducting qualitative research and discussed its defining features. These defining features underpin all qualitative studies irrespective of which qualitative 'genre' the researcher adopts. In educational research one of the most well known and widely used genre is 'case study' research which the following section will now address.

Section 2: Case Study Research

Introduction

Case Study Research is one of five main qualitative traditions or 'genres' outlined by Cresswell (1998). He defines case study (1998) as an "exploration of a "bounded system" or a case (or multiple cases) over time, through detailed, in-depth data collection involving multiple sources of information rich in context" (p.12). Like Stake (1995), he sees case study in holistic terms in which the case is an object of study in itself. However some writers such as Yin (1994) and Matthew, Huberman and Miles (1994) see case study more as a methodological approach than as an object of study in its own right. This difference in understanding probably explains why these writers tend to lean more towards the positivist paradigm in their analysis of case study research. Stake on the other hand, like Lincoln and Guba (1985), firmly roots case study research within the interpretive or naturalistic paradigm. As a form of research, Stake (2000a) reminds us, "case study is defined by interest in individual cases, not by methods or inquiry used" (p. 435).

Thus before undertaking case study research a researcher needs to have a clear understanding of which interpretation best describes what case study actually is in his or her own mind, as it is this understanding which will ultimately determine the shape of the study. As I subscribe more to the interpretive understanding of case study research as formulated by Stake (1995), and therefore used this interpretation to shape this particular study, I will now discuss the different types of case study as described by him, next.

Types of Case Studies

Stake (1995), distinguishes between three types of case studies: intrinsic; instrumental and collective. In an intrinsic case study, the case is studied because the researcher has a fundamental interest in the case itself and wants to or needs to understand it more fully. Understanding of the case itself is the driving interest

rather than the need to learn something about other cases or about some general problem. An intrinsic case study is similar to what Yin (1994) calls a 'descriptive case study'.

In an instrumental case study, an issue rather than the case itself is the main focus of inquiry. In this situation the case is studied primarily to provide an insight into some general phenomena that the researcher wishes to understand, so the case itself then is seen as instrumental to accomplishing something other than the understanding of the particular case. This does not mean that the case can be ignored. On the contrary the case is still important and still needs to be examined because it plays a supporting role in facilitating our understanding of the issue being studied. This creates its own tensions in the research process as the researcher has to skilfully negotiate between the competing demands of the general i.e. the issue and the demands of the particular i.e. the case. Striking this balance can be extremely difficult to achieve. An instrumental case study is similar to what Yin (1994) calls an 'exploratory' case study'.

In a collective case study, a researcher studies several cases to investigate a phenomenon or issue. Stake (2000a), sees collective case study as an extension of the instrumental case study. In this scenario several cases become the focus of inquiry because it is believed that understanding them will lead to better understanding, perhaps better theorizing about a still larger collection of cases. A collective case study is similar to what Yin calls an 'explanatory' case study, although his understanding of multiple case study design as the basis for 'analytic generalisation' is very different from what Stake calls 'naturalistic generalisation'. For Yin analytical generalisation is a way of generating theory or 'grand generalisations' from case study research. Stake (1995), is far more circumspect on this, arguing that case study is a poor basis for generalisation because the "business of case study is particularisation not generalisation" (p.8). For Stake case study research does not lead to generalisation in the way that those working in the positivist paradigm, understand it. Instead it represents a powerful way of building 'naturalistic generalisation', a form of tacit understanding in which the experiences

of the particular as made public by the researcher are generalised by the reader to other situations in the light of his or her knowledge of similar cases.

Disliking the use of the term 'generalisation' because of its 'nomothetic' connotations and association with the natural sciences, Lincoln and Guba (2000), suggest the term 'working hypothesis' as first proposed by Cronbach (1975), as an alternative to Stake's 'naturalistic generalisation'. They argue that case study research can produce 'working hypotheses' that allow conclusions from one study to be transferred to another context. For them the issue is not one of generalisability but rather one of 'transferability' that depends on the degree of fitness between the sending and receiving contexts.

Irrespective of whether one is conducting an intrinsic, instrumental or collective case study, Stake advises that the case or cases should be chosen in order to maximise learning. Opportunity to learn rather than a concern for representativeness should be the main determinant.

Designing and Organising case study research

The first task in designing case study research is to design the conceptual framework within which the research can proceed. The conceptual framework is determined by the study's research questions, sometimes also referred to as issues. Issue questions are identified early on in the research process and they are important for giving an initial focus to the study and in some situations may even assist the process of gaining entry to a research site. In accordance with the concept of 'emergent design' the initial issue questions, often referred to as 'etic issues' drawn up by the researcher, may change as the study develops and issues of importance to the participants i.e. 'emic issues' emerge and take centre stage. This is why Stake (1995) warns that in case study research "there resides an abiding tension between the case and the issues as they both compete for scarce resources irrespective of whether one is doing an intrinsic or instrumental case study" (p.25).

Once a study's conceptual framework has been devised and the issue questions formulated, the fieldwork can commence. Stenhouse (1978) suggests that the organisation of a case study should be considered in three stages, namely, the 'case data', the 'case record' and 'case study', sometimes also referred to as the 'case report.'

In the case data stage the researcher gathers the raw data for the study. During this stage the researcher needs to address key organisational issues such as negotiating access to the research site, seeking out key informants, clarifying entry and exit points, determining ethical guidelines and agreeing confidentiality procedures. The researcher also needs to decide what data gathering tools to use such as interviews, observations, surveys, documentation etc. Ultimately the case data is made up of all of the information one gathers about a case, all of which needs to be carefully documented, dated and archived as it constitutes a major part of the 'audit trail' upon which a study's 'trustworthiness' depends. As quite a large volume of material can be gathered during this stage the researcher needs to exercise due diligence in ensuring that the material is properly stored and that back-up copies are maintained.

Once the raw case data has been gathered and organised the researcher then produces the 'case record'. This is a critical stage in the research process as the case record represents the intermediate stage between fieldwork and the writing up of the case study or case record. Stenhouse (1978) describes the case record as "a condensation of the case data, produced by selective editing without explicit comment.....to be regarded as an edited primary source" (p.37). In producing the case record, the researcher needs to collate and organise data from various sources and identify and code the most relevant data which will form the basis of case analysis and the writing up of the case study. This 'reduced' data set which may be organised chronologically and/or topically makes the task of accessing key case data much more manageable and makes the process of writing up the case study a lot less difficult.

The case study or case report is the story of the case made public in written form. The final case study should take the reader into the case situation and experience (Patton 2002).....and strive to portray “ what it is like to be in a particular situation, by catching the close-up and ‘thick description’ of participants’ lived experiences of, thoughts about and feelings for a situation “ (Cohen and Manion, 2000, p.182). To do this effectively the researcher must be capable of “weaving descriptions, people’s words, field note quotations, and the researcher’s own interpretations into a rich and believable descriptive narrative” (Strauss & Corbin, 1990, p. 20). It is this skilfully crafted narrative, which enables the reader to understand the case as a unique, holistic entity that ultimately defines the essence of case study research.

Section Three: Qualitative Inquiry, Case Study and this Research

Introduction

This section deals with the methodology of this study in order to provide an insight into how the research was conducted. The research, which was exploratory in nature, was conducted within the qualitative paradigm and the standpoint of the study is interpretive. Of the five main qualitative research traditions identified by Cresswell (1988), the case study method was deemed the most appropriate because as Yin (1994) and Merriman (1988), remind us, case study research explores a single entity or phenomenon (the case) bounded by time and activity (a program, event, process, institution, or social group) and collects detailed information by using a variety of data collection procedures during a sustained period of time. It goes without saying that both the WFL project and the Thin Client project fit this classic definition of a 'case', and therefore for the researcher a case study approach became the inevitable, and probably indeed the only methodological choice, in order to understand these cases in their entirety.

Furthermore one of the great strengths of case study research is that it is "both a process of inquiry about the case and the product of that inquiry" (Stake 2000a, p.436). This makes it particularly suitable to the study of innovative projects where the process of their introduction and assimilation into organisational contexts can be particularly revealing and vital to our understanding of outcomes. As Atkinson and Delamont (1981), say in their explanation of case study research:

"In general terms, this approach rests on the belief that the innovation to be examined cannot be treated simply as a set of objectives, or as a variable or variables to be measured. Innovations 'on paper' maybe transformed radically, in the course of their actual implementation. The reality to be investigated then, is a complex social reality of everyday life in institutional settings." (p. 27)

Comparing the study of an innovation to a study of a play, Parlett and Hamilton (1976), advise that it is not enough to simply study the text. The performance must also be taken into account because in order to understand it fully we must see it in action. Applying this analogy to the study of innovations they argue:

"It becomes imperative to study an innovation through the medium of its performance and to adopt a research style and methodology that is appropriate. This involves the investigator leaving his office and computer printout to spend substantial periods in the field. The crucial figure in the working of an innovation – learners and teachers – become his chief preoccupation" (p. 227) .

To a large extent these two quotes encompass much of what my research inquiry into the WFL and Thin client innovations was about – going out to the field to understand the day to day realities of the innovation in action. Inevitably this involved a focus on the ‘complex reality of everyday’ life in schools as the innovation process got underway, and a focus on the ‘crucial figures in the working of the innovation,’ namely the teachers, in this instance.

The Conceptual Framework

As per Stake's (1995) recommendation, this study's conceptual framework was defined by the research questions, of which there were six in all. Through a detailed investigation of the process involved in implementing these initiatives in schools I sought to address the following key research questions:

1. What are the structural and organisational requirements for the effective use of ICT in schools?.
2. How do teachers perceive the educational benefits of the selected innovation, how are they using the technology, how frequent is that usage and to what extent does the use of technology improve or change their teaching methods and style? What do teacher's perceptions and willingness to use new technology reveal about teacher's attitude to change?.

3. How appropriate is the technology platform for supporting the integration of ICT in the curriculum and how well has the technology infrastructure been constructed to support the task of ICT integration?.
4. To what extent does the availability of collaborative and communications technology help to support a culture of openness and sharing in schools by facilitating communications and collaboration both within schools and between schools, parents and the wider community?.
5. What level of staff IT competency is required for the effective use of ICT and did teachers receives adequate training of sufficient quality and relevance to support the innovation?.
6. How sustainable and scalable is the innovation? In other words how well has the innovation been integrated into the school environment? Will it require additional resources and efforts to sustain it beyond the SIP project timeframe? Could other schools benefit from this innovation, and if so what would be required to replicate the model at other sites?.

Undoubtedly these questions represent the 'etic' orientation of the researcher as like most qualitative researchers I had very little knowledge about and no experience of the cases to be investigated, prior to commencing research. Therefore these questions or issues were used primarily as a way to organise the study, as a framework for designing and guiding the research, not as a way to straight-jacket the research inquiry. As this was a qualitative study I was only too aware from the outset that my research posture would have to be sufficiently flexible to accommodate 'emic' issues as they emerged in the course of the study. As Stake (1995) reminds us:

"Good research questions are especially important for cases studies because case and context are infinitely complex and the phenomena are fluid and elusive. In a flood of happening, the researcher grasps for something to hold on to" (p.33).

To a large extent the broad based nature of the research questions and the innovations themselves determined the type of case study approach which I needed to adopt, namely a collective case study. The WFL project was fundamentally a multi-site pilot project and therefore I felt that in order to study the innovation from a holistic perspective, I had to adopt a multi-case research approach. Furthermore as the research was designed to accommodate the study of two different innovative SIP projects i.e. WFL and Thin Client, it was intrinsically a collective case study. The collective case study approach also enabled me to conduct the study in accordance with the 'maximum variation sampling' principle in order to understand the phenomenon under investigation most fully.

One of the main advantages of a collective case study is that it facilitates cross-case comparisons which can help to increase the researcher's and the reader's confidence in the study's findings. Another significant advantage is that it can help to deepen understanding and explanation because, as Matthew, Huberman and Miles (1994) explain, "cross case comparisons help us to see processes and outcomes across many cases, to understand how they are qualified by local conditions, and thus to develop more sophisticated descriptions and more powerful explanations" (p.172). As the essence of qualitative research is to enhance understanding of the phenomenon under investigation, it makes sense to undertake a collective case study where the nature of the inquiry and the time available, permits.

Negotiating Access

The bulk of the 'case data' for this research was gathered during the academic year 1999/2000, the first year of the project's implementation. Initially gaining access proved to be one of the more challenging tasks in the 'case data' stage as schools differed in their responses to the request to participate in the research. The initial request to the schools to participate in the proposed research was made by the SIP national coordinator in a formal letter which was sent to the schools in October 1999. It was through this letter that I was formally introduced to the schools with an endorsement from the National Centre for Technology in Education (NCTE) supporting my proposed research work because it was of interest to them in the context of "Schools IT 2000". It was the SIP coordinator's suggestion to write the

formal letter of introduction as he felt this would carry more weight with the schools rather than a direct approach from myself. The understanding was that I would then follow up the letter by contacting the schools directly with a view to setting up an initial meeting with them and developing the research project from there.

I followed up the letters to the thin client school and the five WFL schools at the end of October 1999 via the telephone. I had no problems making immediate contact with the key project personnel i.e. the principals and IT coordinators in either the Thin Client School or the site two WFL schools. As a result I had meetings set up with all three schools within a week of making the initial phone call. Based on these initial meetings, where I had the opportunity to discuss my research proposal in greater detail with key project personnel, all three schools agreed to participate in the research project.

Securing the co-operation of the three site one WFL schools turned out to be much more difficult. It took a number of weeks to actually get through to key personnel, i.e. the school principals as they were unavailable whenever I would ring. Despite constantly leaving contact details with the respective school secretaries, phone calls were not returned. I discussed the problems which I was having making contact with the site one schools with the SIP coordinator and he advised me to keep trying while indicating that in the meantime he would try to make some discreet inquiries as to what the problem was. My persistence eventually paid off, when in early December 1999, one of the principals from the site one schools returned my phone calls. This paved the way for a meeting to take place with two of the site one schools on December 7th, 1999. However it was clear from the phone call and the follow-up meetings that the site one schools were reluctant to become involved with this research project. The SIP coordinator was aghast at this as the schools had already personally informed them they would support the proposed research. I wasn't privy to a lot of what was going on behind the scenes at the time but I was aware that both the NCTE and the main project sponsor, IBM wanted this research to go ahead in all five WFL schools, while the site one schools did not want the research to proceed. A more detailed account of the labyrinth of phone calls and meetings surrounding this

issue is included in *Appendix P3, Case Record, Volume 111*, which forms part of the case record for this research. Suffice to say at this point, that a breakthrough occurred in February 2000, when two of the three site one schools finally agreed to participate in the research. I can't say precisely what changed their minds but I think it would be reasonable to surmise that they were 'persuaded,' by the SIP national coordinator and IBM to re-think their stance.

In the meantime while all of these negotiations with the site one schools were happening, I had already begun my research work with the Thin Client School and the both site two WFL schools. When the two site one schools came on board, in February 2000, my research base expanded from three to five schools comprising four WFL schools and the Thin Client school. The remaining WFL school resisted becoming involved with the research process until May 2000 when the research data gathering phase was nearing completion. Consequently I had minimal contact with this school. Nonetheless the amount of contact established with this school through my attendance at project strategy meetings and through interviews conducted with a handful of staff, including the IT coordinator, enabled me to include this school as part of the final case study.

Data Collection

The data gathering stage of this research was guided by the principle of 'triangulation' as one of my prime concerns was to ensure a robust research design and process. To this end a variety of data tools were used to support the research design and process. These tools included:

- Classroom observations of how ICT was being used to support teaching and learning. These occurred during the period – November 1999 to June 2000 and took place in the three WFL primary schools and the Thin Client school only. Classroom observations did not occur in the two post-primary schools. The detailed observation notes conducted at each schools are available in *Appendices S3-W3, Case Record, Volume 111*.

- Attendance at WFL joint site meetings and staff training courses for the Thin Client project during the period October 1999 - May 2000. Immediately prior to commencing data analysis, I also attended an additional joint site meeting of the WFL schools in September 2001. A summary of what transpired at these meetings and accompanying school presentation report-outs are available in *Appendices Q3-R3, Case Record, Volume 111*.
- In-depth interviews with key personnel i.e. I.T. coordinators, school principals and teachers during the period May -July 2000 in all six schools. I also conducted a follow-up interview with the IT coordinator in the thin client school in March 2002 during the data analysis stage of this research.
- Analysis of relevant documentation which included documents voluntarily offered to me by school personnel, report-outs made by schools at joint site WFL meetings and project documentation given to me by the SIP national coordinator. Naturally some of these documents contained confidential information and therefore I have not included them as part of the case record. They were used however to inform part of the case study, especially to fill in the 'missing-gaps' in the researcher's knowledge of the cases, especially during the final stages of data analysis, and to establish a level of convergence between the different data sources.

Overall though the two dominant data gathering tools for this study were observations and interviews and I will now look at these more closely in the context of this research.

Observation

In field work research the principal observation methods are 'participant observation' and 'non-participant observation' (Cohen and Manion, 2000, Bell, 1993.) In participant observation, observers become part of the activities they are researching usually by 'going native' and becoming part of the group. In non-participant observation, the observer remains 'aloof from the group activities they are investigating and eschew group membership' (Cohen and Manion, 2000, p. 187). Both methods are not without their critics. Accusations of 'subjectivity' and 'bias'

are frequently hurled at participant observers while non-participant observers are accused of contaminating the research process as it is argued that their very presence as detached observers affects people's behaviour. Qualitative researchers overcome these criticisms by arguing that there is a certain amount of subjectivity and bias in all research, including 'quantitative' research and that acknowledging this 'subjectivity' and being sufficiently sensitive to it so as to minimise it, is part and parcel of good research design. Furthermore they also argue from an epistemological stand point that the 'knower' and the 'known' are interdependent and that meaning is not given in the situation but emerges from the situation as a result of both observation and the researcher's capacity to 'indwell.' On a more practical level it is argued, quite sensibly, that the process of prolonged engagement in the field means the observer's researcher status becomes less prominent as participants become accustomed to the observer's presence.

Although the distinction between participant and non-participant observations is a useful one, it should be pointed out that there are degrees of variations within each of these categories. Gold (1958), best captured these variations when he discussed four different types of observer roles: complete participant, participant as observer, observer as participant and complete observer. I would describe my research stance in this study as that of 'observer/participant', not in the strict sense of Gold's definition, but more in the spirit of what Patton (1990) describes as "the challenge [for the researcher] is to combine participation and observation so as to become capable of understanding the program, [setting, participants] as an insider while describing the program for outsiders" (p.128). As Maykut and Morehouse (1994) advise: "What will dictate how much we are a participant and how much an observer at any given moment is our judgement of what it takes to understand the situation from the inside out" (p.72). In this study the observer/participant role performed this function best.

In my role as observer/participant I interacted with participants in both the WFL and Thin Client projects in many ways. This role encompassed many different situations ranging from formal observations of ICT usage in class and at other project events

to more informal observations as I interacted with staff in the staff-rooms during break-times and with the IT coordinators and principals in between formal classroom observations and at joint site meetings etc. All formal observations were systemically recorded as field notes while informal observations were recorded in field note format, only in situations where I felt they were of significant value to the research process and would not compromise participants. As I see it the opportunity to conduct informal observations is a by-product of the process of conducting formal observations and their real value lies in the extent to which they facilitate the researcher's tacit understanding of a situation. It is neither necessary and in some situations not even ethical to formally record all instances of these encounters.

In keeping with the spirit of emergent design, I adopted an open-ended approach to the formal observations sessions that I conducted. This meant that I did not use structured recording techniques but rather relied on narrative data and 'thick description' to record what I was observing. Following each observation session, I typed up my notes almost immediately after I returned from the field. My field-notes also doubled up as my 'diary' or 'reflective journal' as while writing up the notes I also recorded my thoughts and reflections on what I had observed. When observational notes are combined with reflective comments in this way, the term 'conceptual field notes' (Mckernan, 1994) rather than 'reflective journal' is probably a more apt description. These conceptual notes provided me with a useful record of observations, events, comments and reflections, which informed my research and data analysis strategies as the research process progressed. They also served as a key means through which the audit trail and hence the transparency of this study was established.

Interviews

Interviews represent one of the most effective and illuminating ways of gathering data in any inquiry. In qualitative research interviews may be used either as the primary strategy for data collection, or in conjunction with observations, document analysis, or other techniques. (Bogdan and Biklen, 1982). The interview is a key research tool, if not the major research tool in most qualitative research because it is through interviewing that we 'enter into the other person's perspective' (Patton,

2000. P.341) or get inside peoples' heads. We interview people to find out from them those things we cannot directly observe. Patton (1990) identifies three types of qualitative interviews: (1) the informal conversational interviews; (2) semi-structured interviews; and (3) standardised, open ended interviews. Spradley (1979) identifies a fourth type – the ethnographic interview.

According to Spradley (1979) “ethnographic interviewing involves two distinct but complementary processes: developing rapport and eliciting information” (p.78). These two processes interact continuously throughout the interview cycle as the more the rapport builds between interviewer and interviewee, the more participants are encouraged to talk about their experiences. Developing rapport is all about establishing trust and a good ethnographic interviewer needs to be aware of when rapport is developing well and when it is not. By virtue of the nature of the qualitative inquiry process, most researchers will usually have had the opportunity to build rapport with interview participants long before conducting interviews though techniques such as participant and non participant observation and group interaction.

When skilfully deployed the ethnographic interview can be a powerful instrument for uncovering the richness of participants' experiences and allowing their voices to be heard. Through this technique one can explore and “describe routine and problematic moments and meanings in individual lives” (Denzin and Lincoln 1994, p.36). The ethnographic interview is a way of getting people to talk about what they know which according to Spradley (1979) enables us “to understand another way of life from the native point of view” (p.3). It is a means through which we can come to grasp what Schein (1992) calls those ‘basic assumptions’, which guide peoples culturally determined thoughts and actions and also a means through which we can tap into the well of ‘tacit knowledge’ buried so deep inside peoples' heads that it remains invisible to outsiders and insiders alike. The researcher's role is to straddle these two worlds in order to make the implicit explicit. As uncovering the ‘insider's view’ was vital to this research study, the ethnographic interview, which sought to explore participants' perceptions and experiences, was a key research tool.

The Interview Questions

Prior to conducting the formal interviews with participants I drew up a standardised set of questions, comprising 33 questions for the WFL interviewees and 38 questions for the Thin Client interviewees. These questions were designed to help me address the six key research questions which framed this study. I adopted a standard list of questions because I believed it would facilitate the process of doing cross case comparisons during the data analysis stage. The questions reflected a mixture of (1) Opinion/Values Questions; (2) Feelings Questions; and (3) Knowledge Questions (Patton 2000).

Although I used a standardised approach in devising the questions, I do not want to give the impression that the interviews were conducted in checklist fashion. As far as I was concerned the main purpose of these interview questions was to guide my conversations with participants in order to engage them in the research process. An interview as Simons (1992) reminds us, “should be a conversation piece, not an inquisition” (p.33). That is why the beginning of each interview commenced with a number of questions not on the formal interview list relating to teaching style, teaching experience, length of service in the school, subject areas etc. These non formal questions served as ‘ice-breakers’ – a means of building up rapport with participants and opening up conversation. Once this rapport was established it was easier to start dipping into the list of formal questions in a relaxing, more conversational manner.

In the spirit of this conversational approach, not all 33 questions were addressed to all participants. Good interviewing is as much about good listening as it is about asking good questions. It also involves good judgement. During an interview these elements interact continuously as the researcher decides which questions are best addressed to which informants. This meant that in certain cases some questions could only be meaningfully addressed to the IT coordinators and principals as they were the only informants sufficiently knowledgeable about specific aspects of the project to answer them. In other cases interviewees provided detailed responses to one question which disclosed information that another question was designed to address. During the interview process I was constantly listening to what people

were saying and making judgement calls about which questions were appropriate to each individual candidate and which questions had already been addressed by a previous response. At all times I strove to conduct the interviews in a conversational manner and therefore I treated my interview questions as a guide not a checklist.

In order to accommodate the differences between the WFL project and the Thin Client project, the list of questions which I devised for the Thin Client project participants differed somewhat from those directed at the WFL participants. Despite these differences the purpose of the questions remained the same as they were still designed to address the six key research questions, but the wording and phrasing of questions had to differ in order to capture the different project experience. A list of the two sets of questions addressed to participants in each project is included in *B2, Case Record, Volume 3*.

Selecting Interview Candidates

The concept of 'multiple realities' and the principles of 'triangulation' and 'maximum variation sampling' all influenced my choice of interview candidates. Through the medium of the interview I wanted to explore the meaning of the project experience from the perspective of the IT coordinators, the schools principals and the teachers. Exploring the 'multiple realities' of these three different groups was also in itself a form of 'methodological triangulation' designed to increase the credibility of the research process and hence the confidence in the research findings.

As both the IT coordinators and principals were 'key informants' I was keen to interview these participants in each school, subject obviously to their willingness to take part in this part of the research. They all agreed to participate and as a result I conducted in-depth interviews with all six IT coordinators and five principals. As one principal had not engaged in the research process up to that point, I did not request an interview of this candidate as I felt it was unlikely to be granted.

In selecting teachers to be interviewed I was very much at the mercy of the discretion of the schools and the dictates of the school timetable. My wish list included five to seven teachers in each schools, representing a balance of male and female, younger and older, and teachers who could be described as enthusiastic and not so enthusiastic about IT in schools. I discussed these requirements with the school principals and IT coordinators and they indicated they would try to accommodate these criteria when selecting candidates for interviews. In fairness most schools selected interview candidates who met these criteria. Two schools, i.e the Thin Client school and one WFL primary school put forward virtually their entire staff for interview and in these cases I seized the opportunity and went ahead and interviewed everyone I was offered. As a result I ended up conducting a total of 49 (n=49) in-depth interviews comprising teachers, principals and IT coordinators in all six schools. I also conducted an interview with one of the key IBM project managers who worked in close contact with the schools and the NCTE, in order to get an insight into the project's development from their perspective.

Conducting the Interviews

Interviews represented the final stage of my field research and they were conducted at the end of the academic year 1999/2000, except for the formal interview with the IBM project manager which took place in October 2001, just as data analysis was commencing. The first of the interviews commenced at the end of May 2000 and the final interviews were conducted by early July 2000. Each interview was conducted in private usually in a classroom which was set aside for the duration of the interview and lasted for approximately 30 – 45 minutes. To minimise the disruption to the school, interviews were conducted back-to-back. At the beginning of each interview I sought the permission of each candidate to tape record the interviews and promised them a copy of the full transcript. I also assured candidates that I would stop the tape recording at any time if there was something they wished to say off the record. I was keen to tape record the interviews as much as possible because as Stenhouse (1982) argues tape recording is better than note-taking because it “protects the interviewee against misrepresentation, captures the vividness of speech and preserves a full record” (p. 267)

Most interviewees were happy to have the interviews tape recorded, and on rare occasions I was asked to stop the recordings where people had off the record comments to make. A handful of interviewees asked me not to tape record the interviews at all and in those situations I respected their wishes and took copious notes instead. They were also sent a typed copy of the notes I had taken. Although time consuming and costly, sending typed transcripts of interview data is an important part of member checking'(Linclon and Guba, 1985) which adds to the trustworthiness of a study.

To preserve the spontaneity of the interview process I did not issue candidates with a list of the questions before the interview began. I felt that this was the best way of maintaining a conversational interview style and exploring people's perceptions and experiences in a natural and un-contrived manner. I also used 'probes' to direct the flow of the interviews and to seek clarification and further details as the interviews unfolded. Patton (1990) defines a probe as "an interview tool used to go deeper into the interview responses" (p.238). As the purpose of the qualitative interview is to gain a deep understanding of the interview's experience and perspective, probing is necessary to achieve depth of understanding. As Simons (1982) points out, "Listening by itself does not always lead to depth of understanding. Probing is necessary to get behind the expected response to test the significance of what your are being told" (p.35). However when using probes the interviewer must do so with great sensitivity and care so that the interviewee does not feel trapped. "Probes should be used primarily to expand upon an incomplete answer. They should not be used to badger a respondent into giving up every piece of information he possesses"(Kane 1995, p.69).

I found probing very useful when it came to exploring participant's feelings on certain issues, particularly in relation to areas like teacher's non-use of the instructional planner. In such cases it was necessary to use probes to get beyond people's initial explanations of it being too time consuming or too procedural, to get to the heart of the issue, which more often than not related to deeply held beliefs about how teachers have traditionally planned and organised their lessons.

Data Analysis Strategy

In analysing data, qualitative researchers tend towards an inductive approach to the analysis of data, meaning that critical themes emerge out of the data (Patton, 1990). It is a perplexing and lonely task as the researcher strives to make sense out of the data by categorising it in terms of themes, dimensions or codes (Cresswell 1998). Because no consensus exists for analysing qualitative data, qualitative analysis requires a lot of creativity as the researcher takes on the daunting challenge of organising raw data into logical, meaningful categories, examining this data in a holistic way and finding ways of communicating what it all means to others. The purpose of data analysis is to create meaning or make sense.

In this research study the biggest challenge I faced during data analysis was how to make sense in a comprehensive, transparent and logical manner of the huge amount of raw data which emanated from the research interviews. The approach I adopted was influenced at times by Matthew, Huberman and Miles' (1994) structured approach to qualitative analysis, at other times by Hycner's (1995) phenomenological approach to analysing interview data, and at other times again by Glaser and Strauss' (1967) constant comparative method of data analysis, discovering in the process that there is no off the shelf formula for doing qualitative analysis as it is fundamentally a creative process. Ultimately each researcher has to decide which approach or which combination of approaches best fits his or her own style of working and the task in hand.

Matthew, Huberman and Miles (1994) define qualitative analysis as consisting of three concurrent flows of activity – data reduction, data displays and conclusion drawing/verification. Data reduction they argue is “the process of selecting, focussing, simplifying, abstracting and transforming” the research data (p.10).

My first task once all the interview data had been fully transcribed and member-checked was to read and re-read and listen to the interviews several times to get a ‘sense of the whole’. As much as possible I endeavoured to enter into the world of

the interviewees by listening carefully to what they were saying while suspending or 'bracketing' my own interpretations. I then began to look for patterns and themes emerging from the data by doing a content analysis of each interview. This involved highlighting recurring words and themes in the data and making margin notes at key points in the transcripts. From there I produced a hand written 'summary' of each interview which consisted of key points only. I then merged the summary data from each interviewee according to case on the basis of the patterns and themes which I saw emerging to produce an overall summary sheet containing the main points of the aggregate data for each case. These 'case summary' sheets are included in *Appendix O3, Case Record, Volume 111*. They represent the first stage of the data reduction process.

My next step was to begin building the data displays. A display as defined by Matthew, Huberman and Miles (1994) is an "organised , compressed assembly of information that permits conclusion drawing and action" (p.11). They cite two very good reasons for building displays; (1) they help the researcher to avoid premature analytic closure and (2) they are a way of becoming intimately involved with your data because in order to build displays you have to adopt a very rigorous and disciplined approach to analysis. Consequently "You come to know what you display" (p.91). Building displays is another phase of the recurrent data reduction cycle.

I built my displays from the interview data using the six key research questions as the 'unit of analysis'. To do this I took the list of formal interview questions that I had used during the interviews and analysed them to see which questions and responses best addressed the six main questions. I then made a matrix display for each main question on separate sheets. This matrix comprised the main question and a subset of four to six questions from the formal interview question list. Not every question made it into the matrix composition either because they were 'redundant' questions which I had never actually used while interviewing or because I didn't feel they sufficiently addressed the main questions. With the key unit of analysis

determined and the matrix display format devised, I was now ready to move onto the next step in the data reduction process.

This involved returning to the main interview data to begin compiling the 'monster dog' or 'meta-matrix' (Matthew, Huberman and Miles, 1994, p. 178) data reduction sheets. During this process my 'unit of analysis' (p.65) was further refined to include each individual case and each individual interview participant. A code representing each individual case (i.e. school) and each interview respondent (i.e. teacher, IT coordinator and principal) was then included in the matrix. With the design of the matrix completed I then returned to the original interviews to commence the process of unitizing the data (Lincoln and Guban 1985). This involved electronically 'cutting and pasting' chunks of data or 'units of meaning' from each interviewee for each case into the key research question matrices. For the most part these 'chunks of data' that were pasted onto the meta matrices contained the original speech i.e. 'thick descriptions' from the interviewees. Minimal editing occurred where necessary to accommodate the confines of the matrix framework. I should point out that the 'units of meaning' were determined as much by a careful reading and re-reading of the interview transcripts as by the original interview questions. This tactic threw up some pleasant surprises as frequently I found that although I hadn't formally addressed a question to a particular individual, they had in fact addressed some aspect of that question. Consequently that part of their response was included in the appropriate section of the relevant matrix.

At the end of this process I ended up with an analytical framework for each case (i.e. each of the six schools). Each case analytical framework comprised six separate matrixes representing each of the key research questions, coded and organised according to each interviewee response and case. A copy of this analytical framework is included in *A2-F2, Case Record, Volume 11*. This was an invaluable exercise as it not only gave me the opportunity to further 'indwell' into each individual case and come to know the 'recurring regularities' in the data, but it also provided an excellent resource around which I could begin writing the case study for each case around which chapters five and six are constructed. As Matthew,

Huberman and Miles (1994) remind us, "the issue with any matrix is not what kind of matrix it is but what it does for your understanding of the data... the test of any matrix is what it helps you understand and how valid that understanding is" (p. 242).

Coming to grips with and understanding the dynamics of each individual case is an important pre-requisite for doing cross case comparisons as without this understanding it's very easy for superficiality to set in. However when it came to doing the cross-case analysis, I found the meta-matrices in the original analytic framework too detailed and too 'descriptive' to work with. I then had to go through yet another 'analytic' data reduction cycle. This entailed summarizing the meta-matrix data from the main analytic framework into much smaller 'units of meaning' which still maintaining the tripartite unit of analysis structure (i.e. main research questions, case, interviewee). My goal was to reduce the data into manageable 'chunks' so that the matrices for each case contained only a handful of pages. This involved reducing large parts of the interview data to key words and phrases, while occasionally I also had to use my own words to make contextual sense of what the interviewees were attempting to say where key words and phrases didn't adequately convey the meaning. A copy of this reduced summary analytical framework is included in *Appendices G2- L2, Case Record, Volume 11*.

With the reduced analytic framework completed, it was now much easier for me to do cross case comparisons as all of the data across the cases was not just comparable and standardised according to the same metric, but available in a highly succinct format. The 'patterns', the 'themes' and the 'emic issues' emerging from the data were now readily identifiable, as I could quickly move back and forth across each of the six cases, noting the recurring regularities and the levels of convergence and divergence across cases. This final data reduction process provided the foundations for the interpretative phase of data analysis from which meanings could be confidently extracted from the data, cross case comparisons made and conclusions drawn. (Patton 2000, p.465), all of which forms the essence of chapter seven.

Just as I was completing the final data analysis steps and about to move into the formal stage of writing up the case study, an unexpected development occurred. The SIP national coordinator contacted me to see if I would be willing to take on the task of preparing an 'Interim Report' on the progress of the Wired for Learning project for the Minister of Education and Science. I agreed to take on this task. As a result of this I ended up having quite a lot of in-depth meetings with key members of the WFL project core team i.e IBM and the NCTE during the period February to July 2002. As part of this process I was given access to some confidential research data that had been gathered at the 5 WFL schools after I had done my original research. I mention this for couple of reasons. Firstly it gave me the opportunity to test out the significance and accuracy of my research findings with people intimately associated with the project. It also provided me with the opportunity to 'see' the project from a different perspective – from the point of view of actors – other than school personnel, who also had a key role to play in the project's development. Undoubtedly, the additional insights gleaned from this process influenced to some extent how I shaped the final case study narrative, although I did my utmost to keep the narrative firmly grounded in the original case data.

The Case Study Narrative

What I call the case study narrative is equivalent to what Stenhouse calls the 'case study' and others the 'case report'. It is the story of the case communicated in written form after the case record has been constructed from the raw case data and the analysis has been reified. In constructing this case study narrative the major challenge I faced was managing the inherent tension between the 'case' and the 'sum of the cases', and between the 'emic' and the 'etic' issues. While I commenced this work as a collective case study, I soon realised that the 'intrinsic' nature of each case could not be overlooked for it was here that 'thick descriptions', 'experiential understanding' and 'multiple realities' emerged most fully. It was here too that 'emic' issues most naturally emerged. Perhaps this is why Stake (2000a), argues that while "we may simultaneously carry out more than one case study, each case study is a concentrated inquiry into a single case" (p. 436). This means that the analysts first and foremost responsibility consists of doing justice to each individual case. All else depends on that (Patton 2002).

This is why I kept the cases centre stage within the context of the analytical frameworks and why I choose to tell the story of each case in the case study narrative rather than just dealing with cross-case comparisons. It also explains why in the final analysis, I presented my findings based on the 'emic' issues which emerged from the data rather than the 'etic' issues which I used to frame the study and guide the analytical framework. At the end of the day as Stake (2000a) advises, "the issues used to organise a study may not be the ones used to report the case to others. Observing is different from presenting the case report. In the end, it may be the anticipated issues of the readers that will structure the report" (p.441). Ultimately the case has its own story to tell and the researcher's responsibility is to create the conditions which enable that story to unfold so that readers come to know the 'lived experience' of all that dwells within.

Chapter 5

Case Studies - The WFL Schools

Introduction

This chapter contains five case studies conducted at the Wired for Learning schools. Both the names of the participants and of the schools will remain anonymous. The schools will be referred to as school one, school two, school three, school four and school five. The research methods employed in compiling these case study vignettes include classroom observations and video recording of ICT usage, participant observation at WFL project meetings and at training courses, school and project document collections and tape recorded in-depth interviews with teachers, IT coordinators and principals. The level of access granted to the researcher, which varied from school to school, determined the amount of 'triangulation' data that the researcher could gather at first hand. This means that in some cases the researcher had to rely heavily on interview data, observations at WFL project meetings and information informally communicated from the WFL project core team to 'fill the gaps' in order to build an authentic and reliable case study.

As the Wired for Learning project involved two sites comprising a total of five schools, the chapter is organised in such a way that it deals with the three schools in site one before proceeding to the two schools in site two. This makes sense both from a logical point of view in terms of the project's history and development and from a contextual perspective as local factors influenced how the project was adopted and implemented at each site, and also had a bearing on the level of researcher access and engagement in the field. The vignettes outlined in this chapter, based on the composite data, seek to report the findings which will be analysed in chapter seven. However before proceeding to the school case studies, this chapter will first outline some generic WFL project information which is vital to an over all understanding of the Irish project and for the school case studies.

Section One

Wired for Learning in Ireland - Project History

As already outlined in Chapter two The Wired for Learning project in Ireland commenced in June 1998, with the signing of a Letter of Agreement between IBM and the Department of Education and Science (DES). Five pilot schools were chosen for inclusion in the project. The first three pilot schools which formed Site One were selected in August 1998. Site Two comprising two schools joined the project in March 1999. At the outset it was decided that the project would be established as a SIP project and that the national coordinator for the SIP programme located at the National Centre for Technology in Education (NCTE) would manage the project on behalf of DES in conjunction with the IBM project manager.

From an operational perspective the project can be divided into two phases. Phase One which represents the project start-up and foundation stage, encompasses the period June 1988 to June 1999. Phase two, which represents the implementation stage commenced in September 2000.

Scope of the Project and Statement of Work

During phase one both IBM and the NCTE engaged the teachers in an intense series of meetings and workshops to develop the scope of the project in Ireland, to localise the software for the Irish education system and to train teachers in both basic ICT skills and the Wired for Learning Software. During the Autumn of 1998 extensive consultation was carried out by IBM with the site one schools, the NCTE and the Department of Education and Science The purpose of these consultations was to:

- Identify and prioritise barriers to academic achievement for students in Ireland
- Explore how technology solutions can be applied to overcome these identified barriers

- Determine the resource and change planning required to implement these solutions in the desired timescale

The consultation exercise with schools was based around facilitated workshops that were delivered separately at each school which was attended by a steering group of teachers. In all four workshops were delivered at the three site one schools during the months of October and November 1998. Each session explored a number of barriers to academic achievements that had been identified by interviews conducted earlier with school principals and DES. During these workshops a series of key questions helped to explore if the Wired for Learning Project could address the identified problems and then prioritized the problems to be addressed from the schools' perspective. A summary of the main workshop findings is included in *Appendix X3, Case Record, Volume 111*. During this period IBM also conducted regular presentations and communication with school staff about Wired for Learning and conducted ongoing planning with the SIP National coordinator.

In November and December 1998, two similar workshops were conducted with the DES Inspectorate to ensure that the findings from the school workshops were broadly applicable to the Irish Education system and to investigate further requirements for any proposed solutions. An internal IBM project Definition workshop representing key players from IBM Ireland, IBM Corporate and IBM R&D was conducted during November. A final project definition workshop took place in January 1999 comprising the principals and IT coordinators from all three schools and representatives from DES, IBM Ireland and IBM Corporate and the NCTE. This workshop provided the necessary agreement from all project stakeholders on the scope of the project and the statement of work. This was officially signed off on by all parties in April 1999.

Project Goals and Themes

An analysis of the project definition document reveals that the project's main aim was to create systemic and sustainable change in the Irish education system through the use of technology. It had six main goals, three of which were education specific and three of which were of a corporate nature. The education goals were as follows:

- Enable systemic and sustainable change in the Irish education system through the use of technology
- Enhance the relevance of education for children by using Information and Communications Technology (ICT)
- Prepare people for a future world which relies heavily on ICT

A detailed list of objectives was drawn up to support these goals and they are included in *Appendix Y3, Case Record, Volume 111*. The three major themes that emerged from the project goals and objectives were:

- The deployment of ICT to help tackle identified literacy and numeracy shortcomings
- Enabling the development and sharing of resources and knowledge between teachers within and across primary and post-primary schools
- The establishment of new means of communications and collaboration between schools, parents and the wider community.

While the themes had clear individual objectives, they shared a common core of collaboration as illustrated by the diagram overleaf.

It is true to say that when these themes were being defined no one knew for certain how the Wired for Learning software could best be used. The version of the software, version 4.6, which was being demonstrated to the teachers at that time, had only been used in the U.S. It was acknowledged that as Ireland was the first country in Europe to use it, extensive work would have to be carried out at IBM's Hursley R&D laboratory in the UK throughout 1999, to adapt it to the Irish school system and to iron out some usability issues i.e. U.S. terminology, dates and spellings. This,

plus the fact that Wired for Learning would require technical changes of a complex nature as it migrated from a Louts Notes Release 4.6 to a Notes release 5.0 platform towards the end of 1999, was identified as one of the risk factors which could impact on the success of the project.

<p><u>Literacy</u> Expert forum Classroom Tools Assessment and Recording Best Practices</p>	<p><u>Resource Sharing</u> Lesson planning Content development Evaluation Knowledge management Cross subject Cross School</p>	<p><u>Community Links</u> Parent/Teacher communication Ease of access Training Mentors</p>
<p><u>Core</u> Using technology to create, share and disseminate Changing communications patterns A culture of openness and sharing The Relevant skill set to participate in this environment Realising the benefits of input to and from the community Integration of ICT into everyday school life</p>		

Figure 21 : WFL Themes

WFL Project Structure

Supporting and sustaining a sophisticated project like Wired for Learning required a significant investment in time and resources by all project partners i.e. DES, IBM, the NCTE and the school themselves. As the diagram overleaf indicates the project structure as originally envisaged consisted of three teams:

- A core team which acted at a strategic level and in an executive capacity to oversee the project’s development. It was made up of representatives from DES, IBM and the NCTE.

- A site committee operating at local level on each site comprising DES inspectors, known as project directors, school principals and IT coordinators. From the outset it was agreed that each of the two sites would have the services of an experienced DES inspector acting as a project director who would be deployed for the equivalent of half their time for the duration of the project.
- A school committee operating in each school comprising the principal, IT coordinators, Home/School Liaison (HSCL) teachers, parents and teacher representatives. Each school was to receive teacher release time to facilitate teachers to work on the project.

To ensure the smooth operation of the project, it was agreed that each team would hold project review meetings on a regular basis, either bi-weekly or monthly as project needs dictated.

Project Reporting Structure

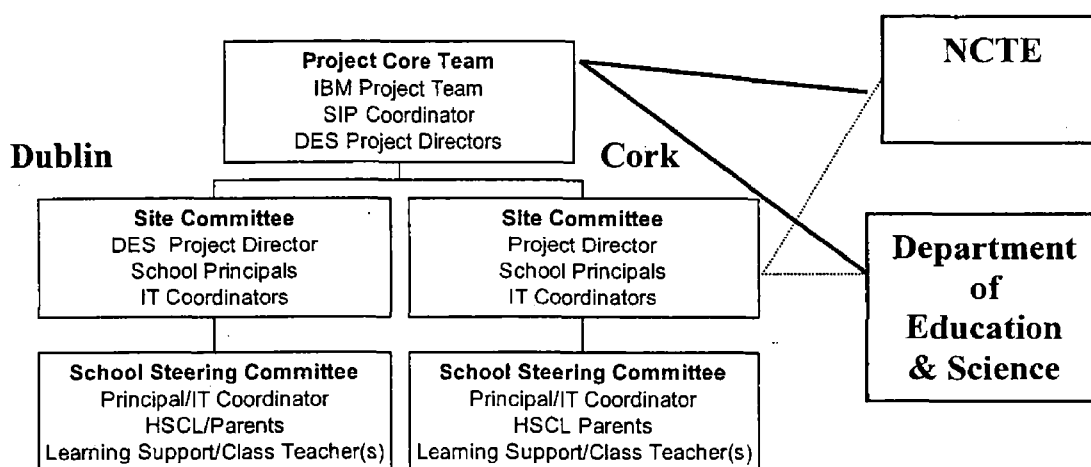


Figure 22: Project Reporting Structure, Source: WFL Project control document.

Training and Professional Development

The majority of teachers had little or no experience of using computers prior to the commencement of WFL. Therefore from the outset teacher training was identified as a priority if the project was to be successful. A multilevel approach to training was adopted consisting of:

- Initial WFL training for experienced IT users
- General IT skills training and WFL specific training for all teaching staff
- Specialised courses and workshops for IT coordinators and Principals

Initial WFL training for Experienced IT users

In the spring of 1999, during the Easter holidays, 16 teachers with experience in IT including the 5 IT coordinators from the schools in both sites were trained on the WFL software by the Reinventing Education Coordinator from West Virginia and IBM's International Training Coordinator. Working in conjunction with the NCTE's National Training Coordinator, this group of lead teachers subsequently designed the training courses and materials for the courses, which were undertaken later that year by the majority of teachers in all five schools. The materials which they developed were also later used both in the UK and in other Reinventing Education sites for training. This cohort of teachers also had the opportunity to enhance their professional skills repertoire as they collaborated with IBM's Hursley Laboratory in identifying changes needed in the WFL software to suit the Irish school system.

General IT skills training and WFL specific training for all teaching staff

As the lead teachers were receiving their initial WFL training, training in general IT skills commenced in all five schools for the remaining teaching cohort under the auspices of the NCTE's national training courses within the Teaching Skills Initiative (TSI) strand of "IT 2000". Delivered in two parts, this training was known nationally as Phase One and Phase Two NCTE Training and was made available to all teachers in all schools throughout the country as part of "Schools IT 2000".

This exposure to phase one and phase two training, laid the foundations for the next stage of the training process, namely WFL specific training, which commenced in the summer of 1999 in all three primary schools and in the autumn of 1999 in both second level schools. The different delivery time-frames reflect structural differences to in-service training across the primary and post-primary sectors. In the primary sectors, in-service training courses are typically delivered during the first week of July just as the summer holidays commence. As a rule primary teachers who avail of in-service training courses during this holiday week are entitled to three days personal leave during the teaching year. Post-primary school teachers do not enjoy this perk. Consequently the WFL training courses was offered as an after-school evening course in the post-primary schools in both sites, during the autumn of 1999.

Training, which was voluntary in nature, was widely taken up across all five schools, with the majority of staff availing of the opportunity. In addition four of the five principals participated in WFL training courses. The high take up of training, which took some schools by surprise and which was achieved over a relatively short period of time was commented on by a number of participants as evidence of teacher commitment and enthusiasm:

"The staff were quite well prepared for the project in that over 70% of them did phase one and phase two NCTE training which is far greater than we expected. We had far greater interest among the staff than we thought, even among the older staff whom we wouldn't have thought would have signed on for it. They flung themselves enthusiastically into it. We trained 20 teachers on WFL initially and then ran a second course because there was a demand for it. People asked to be trained on it. Now whether it was out of curiosity or they felt they were loosing out....Whatever their motivations, they asked to do it and they attended it and they liked what they were doing"

IT coordinator, School 3

Definitely there was a fair amount of enthusiasm for it. The proof of it was that I'm not aware of anybody who hasn't bought into it in terms of committing to training and giving up their time to do their training, and evening training at that, all within their own time. So there was a great taking it on board if you like..... and I have no doubt but that WFL will continue to be used efficiently and effectively. " (Teacher 3, School 1)

"There was a course for WFL last summer and there is another course again this summer and there are 11 teachers on our staff out of 23 doing this course. ... 11 out of 23 is very good when you consider that there are people going away for the whole summer and people who have kids who mightn't be able to do it. Eleven is a big number."

Teacher 4, School 2

Specialised Courses and Workshops for IT coordinators and Principals

The specific training needs of the IT coordinators, their assistants and the principals was given careful consideration and extra courses and workshops were provided for them. These included courses in 'Change Management' and 'Train the Trainer' in 1999 and courses in 'Network System Management and Maintenance', 'and 'Project Management' in 2000 for the IT coordinators and their assistants. Four out of the five principals also attended the 'Change Management' course in the spring of 1999. In March 2000 the principals attended a 'Change Management Workshop,' delivered by Professor Rosabeth Moss Kanter from the Harvard Business School, which was sponsored by IBM.

In terms of additional professional development opportunities, IBM sponsored a week long visit for four principals and one IT coordinator to US Reinventing Education sites in North Carolina, West Virginia and Philadelphia sites in November 1999, to see at first hand how Wired for Learning was being used. One principal from site two and one IT coordinator from site one also attended the annual Reinventing Education meeting in Palisades, New York in December 2000. The key personnel involved in the project in all five schools have also been brought together twice a year since the project commenced to discuss their work and project progress in special workshops that have been hosted by the NCTE and IBM. These forums provided opportunities for the principals, IT coordinators and their assistants to meet their counterparts from other schools and gain fresh insights and new ideas on Wired for Learning's implementation.

State of the Art infrastructure

As a result of their involvement in Wired for Learning, there was a sizeable investment in hardware, software, network infrastructure and telephony, coupled with technical support from IBM in all five schools. In most cases this involved retrofitting of buildings and some classroom refurbishment as rooms were altered to accommodate the installation of equipment and structured cabling for network and electrical points. All schools were equipped with a state of the art networked computer laboratory and the three primary schools also had a PC installed in each classroom. Two IBM laptops per school were also provided. These laptops facilitated teachers who wished to do work at home in the evenings. In the case of one of the primary schools in site one, these laptops were also used by teachers located in temporary prefab accommodation where it would have been unwise to install a fixed desktop. The equipment costs were shared 50/50 between IBM and the Department of Education and Science. As part of their infrastructure commitment, IBM also provided extensive technical support for the schools for the duration of the project.

Teacher Release Time

To facilitate schools in encouraging staff to use the WFL system, teacher release time equivalent to .45 days for primary schools and .25 days for secondary schools was provided through support from SIP. Schools could use these days for WFL project matters at their own discretion. Some schools gave all the time to the IT coordinator while others schools allocated the time in such a way as to encourage mainstream teachers to use WFL. Usually this involved hiring substitutes so that a teacher or group of teachers could be released from classroom duties to do work on different aspects of WFL such as preparing lesson plans.

All in all the intense and thorough groundwork which was undertaken by all parties during project start-up laid the foundations for the implementation phase of the project, which commenced in earnest in September 1999.

Section Two

Case Studies - Site One

Introduction

Site One was made up of a cluster of 3 schools located in a disadvantaged suburban community in West Dublin. As parents for the most part are unskilled, with low educational attainment, unemployment in this community had been traditionally very high throughout the 1980's and early 1990's. However the arrival of the Celtic Tiger in the mid nineties had contributed to an overall drop in unemployment locally as many industries, particularly multinationals had recently set up or were expanding their operations in the immediate catchment area. This had created employment opportunities for parents, albeit mainly in low skilled manual work or poorly paid service related jobs in areas such as cleaning and catering.

Two years prior to the commencement of the WFL project, IBM had established an international call centre and a 200 acre technology campus, employing thousands in the locality. Naturally they were keen to establish the WFL project in some of the local schools and nine local schools were encouraged to apply for the project. The three site one schools were chosen because they were officially classified as disadvantaged and therefore it was felt that they would have the most to gain from this project. Furthermore they were also the only local representation of the three strata of the Irish school system i.e. junior primary, senior primary and post primary. All other schools in the area operated a two system model i.e. one primary school and one post-primary school. Another factor in the selection process was the fact the post-primary school already had a very good IT set-up and it was felt, perhaps naively, that this school could influence and help the other two schools along.

The three site one schools comprised a Junior Primary School (age group 4 –8), a Senior Primary School (age group 8-12) and a 2nd level Community school (age group 13-18). There was a gender mix in all three schools, which is not necessarily the norm in Irish education. As all three schools were located in an area which had only been populated in the last 25 years, the schools were relatively new and were established by the state rather than a religious order. Consequently they were run by

lay principals, one female and two male principals. Most pupils progressed through each of the 3 schools in the course of their education.

Throughout the remainder of this dissertation the site one schools will be referred to as school one, school two and school five respectively. The categorization of the third site one school as school five, reflects the fact that school five only agreed to participate in this research just as my field research was nearing completion. Therefore much of the data for the four main schools had already been categorized according to the school 1 - 4 classification.

Reaction to Proposed Research

Despite the fact that both the SIP National coordinator and IBM were enthusiastic about the researcher's proposed involvement with the project, the schools in site one were initially quite resistant to the idea of research being conducted. Resistance manifested itself in many forms including ignoring and not returning phone calls when the researcher was attempting to gain initial access; making excuses like 'it's too early to be trying to do research on this project'; attempts to undermine and even intimidate the researcher into not attending the first official gathering of the schools in both sites. This was despite the fact that the site two schools who were hosting the event had expressly extended an invitation to the researcher to attend, an invitation that was also strongly endorsed by the SIP National coordinator and IBM.

A full four months transpired from the date when the SIP National coordinator sent the first letter to schools in October 1999, requesting them to cooperate with the proposed research, to the time when the first site one school actually opened its doors to the researcher in February 2000. Shortly thereafter the second school acquiesced while the third school never did, although the researcher did get the opportunity to conduct a limited number of interviews with teachers in the third school (i.e school 5), two days before the summer holidays commenced in May 2000. A more detailed account of the intricate labyrinth of phone calls and attempts to establish meetings with schools conducted by both the researcher and the SIP National coordinator in order to get this research project up and running is included in *Appendix P3, Case Record, Volume 111*.

I raise this issue of access and the problems thereof not only because it is an important part of the case history, but also because it is illustrative of what Sarason (1996) calls the 'complicated embeddedness of the school system,' which has in the past remained hidden from many observers of the system. According to Sarason this has created a situation where our understanding of what goes on inside schools is discussed in terms of the 'psychology of the individual' rather than the complexity with which one is dealing, namely the culture of the school system:

"It rarely occurs to the outsider that the response of the school person reflects in some measure the fact that he or she is in a role that is characterised by duties and responsibilities and is defined by a complicated set of personal and professional relationships with many other people in the setting...The response of the school person to the outsider is a frequent one to others within the school culture. It is not unique but occurs frequently to those who represent other parts of the school system and who wish in some way to introduce a change of some sort into particular schools. ...It may well be that it is precisely because one cannot see structure (sic culture) in the same way that one sees an individual that we have trouble grasping and acting in terms of its existence"... (p. 24-27)

Seen in this light, it is easier to understand people's reactions and behaviour in the broader context of the system within which they operate rather than as individual personality traits and to acknowledge the limitations that this places on one's research endeavors. When the site one schools finally acquiesced to allow this researcher in, I was very much aware that it was for them an uneasy compromise, an arrangement with which they were uncomfortable and which as a consequence made me feel uncomfortable too. The constraints imposed limited what I could do and observe, even to the point of not feeling free to informally chat with members of staff during coffee breaks. Most of the time I felt I was walking on eggshells and had to tread very carefully indeed. Obviously these were not ideal conditions under which to be conducting research. Yet in hindsight it was worth the effort as the research data, particularly the interview data, yielded some powerful insights into the beliefs and values that shape the school and teaching culture and how this influences the system's response to change.

Schools One and Two – The First Meeting

Schools One and Two were located adjacent to each other on the same campus. Both principals had a good working relationship with each other. In terms of the project, the principal from school one appeared to be the main spokesperson and unofficial leader for site one. The principal from school two appeared to follow his leadership on project matters.

My first meeting with both principals occurred in December 1999 when I met them jointly for a formal meeting in the principal's office in school one to discuss my research involvement. It was a very useful and informative meeting even though one of the first points the principals made to me was that the site one committee had made a decision the previous week not to participate in the research project. Undeterred by this obstacle, I was determined to get as much an insight into the schools and the project from this meeting, even if as it looked at the time, that this was the only foot in the door I was going to get. As events transpired this turned out not to be the case.

The meeting lasted for about an hour during which both principals raised a number of issues which were to surface again and again in the course of the research and which alerted my antenna to some of the key issues that I would need to probe as the research progressed. In the course of the meeting both principals were keen to stress the level of disadvantage of the student population and all the attendant problems that this creates for the school and the teachers. Well aware of my involvement with the Thin Client project, they were keen to stress "We are not a middle class school operating in a nice suburban area", the implied inference being we have a lot of other problems to contend with besides technology. One of their big problems it seemed related to staff recruitment and retention, which in an era of teacher shortage, such as that experienced in Celtic Tiger Ireland, was felt most acutely in disadvantaged schools. Foremost among their key concerns at that stage in relation to technology and the project were:

- Frustrations in relation to PC's not working and having to call technicians in to fix them. They found this very disruptive and saw technical problems as among the big issues not just with WFL but also with the whole roll-out of IT to schools.
- 'Bugs' in the WFL software and the proposed upgrade to the software which was creating a lot of angst among the teachers and IT coordinators
- A feeling that IBM hadn't delivered on its promises to date
- A sense of disappointment with WFL as a system. They felt it was restrictive in that you couldn't do mainstream IT activities such as Word-Processing on it.
- A reluctance by the DES, the NCTE and IBM to acknowledge the problems which the introduction of IT was creating for schools.

The other observations from the meeting worth noting were:

- Unlike the initial meeting with the site two schools, the IT coordinators were not in attendance
- The researcher was not shown around the schools nor the computer labs in either school
- The computer in the Principals office was not switched on, nor was it ever switched on in any subsequent visit that I made to the office during this research.
- On several occasions the principal from school one mentioned that for IT to take hold in the school system a change in mindset would be required on the part of teachers. Fear of change was also mentioned a number of times.

School Profiles

From the first meeting and subsequent visits to schools one and two, the level of disadvantage of the student cohort was plain to see. It was unquestionably an area of poverty where many children came from families where social problems were rife. This made the teaching environment challenging, and this challenge was compounded by the fact that the schools also accommodated children from the

traveling community living in nearby halting sites and the children of refugees, many of whom had been recently housed in the locality. The schools were officially classified as 'disadvantaged' by DES which meant that they qualified for extra teachers and resources. Despite the poor and rather run-down environment in which the schools were located, it was clear that the principals, teachers and pupils had a sense of pride about their schools as the exteriors and interiors of both schools were meticulously well-kept.

Both school buildings are attractively designed and laid out. Being modern schools they are typical of many new national schools built by the state during the 1970's in the aftermath of the New Primary Curriculum introduced in 1971. Such schools provide a pleasant environment for the education of young pupils, reflective of the child centered ideology of the new curriculum. (Coolahan, 1981). The buildings were divided into 'blocks' to encourage close co-operation between teachers working with similar age-groups. The rooms were bright, spacious and airy with vaulted pyramid style ceilings. The only telling sign of the local cultural context were the window grills and even these were attractively designed to blend in with the windows and appear unobtrusive. The entrance halls in both schools contained bright cheery murals, children's drawings and pictures of different class groups over the years. However the one thing that stood out most from the first visit and from all subsequent visits that I made to both schools was the pervading sense of silence in the school corridors. The school corridors were so quiet that one would be forgiven for thinking that there were no children here.

School one has 320 pupils and a teaching staff of 21 plus the principal. Five of the teachers and the principal are men. The vice principal, also male is a fulltime teacher. Fourteen of the teachers are mainstream teachers. There are three Special Needs teachers, one learning support teacher, one Home/School Liaison (HSCL) teacher, one Resource Teacher for Travelers (RTT) and one IT teacher. The principal has been the principal since the school was founded, almost 25 years ago. He puts an emphasis on good order and discipline and this is reflected in the ethos and atmosphere of the school. He was the most responsive of all three site one principals in terms of his dealings with me and the most willing to engage in initial discussions around the possibilities of conducting research, even though he had reservations

about it. In many ways he fits the typical 'Manager' style leader as described by Halls & Hord (1987) in their study of the different leadership styles of school principals in which they identified three main types, Initiators, Managers and Responders. Managers, they inform us are:

"efficient in administering their schools and work without fanfare to provide basic support to teachers. They keep teachers informed about decisions and are sensitive to teacher needs. A particularly significant characteristic is that they protect their teachers from excessive demands. They question changes at the beginning and tend to dampen their entry. Once they understand that outsiders, such as the central office, want something to happen in their school, they become very involved with teachers in making it happen; yet, they do not typically initiate attempts to move beyond the basics of what is imposed..... Managers try to do everything themselves rather than delegating. When they do assign jobs, they monitor very closely what the designated person is doing, rather than work with him/her or letting go." (p. 231)

School two has 262 pupils and a staff of 19 including the principal. There is only one male teacher in the school. Both the principal and vice principal are female and the vice principal teaches fulltime. There are twelve class teachers, two Learning Support teachers, one 'Early Start' teacher, one RTT, one HSCL teacher and one IT Teacher. The principal had only been in her post for one year when the WFL project had come along although she had been the school's vice principal for a number of years. From the perspective of leading and managing a change project like WFL she was in a difficult position as her principalship was only a temporary appointment as the main post holder was on secondment for three years and it was unclear whether she would be returning or not. Her leadership style which was probably influenced to some degree by the 'temporary' nature of her post best fits the 'Responder' profile:

"Responders emphasise the personal side of their relationship with teachers and others...They view teachers as strong professionals who are able to carry out instructions with little guidance from them.....They believe their primary role is to maintain a smooth running school by focusing on traditional administrative tasks, keeping teachers content, and treating students well. Another characteristic of responders is the tendency toward making decisions based on immediate circumstances rather than on longer range school goals. This tendency seems to be due in part to their desire to please others and to their more limited visions of how their

school and staff should change in the future. As a consequence, decisions tend to be made one at a time and to be most heavily influenced by the last person they talk to." (p. 231)

It is interesting to note that in both schools most teachers who were interviewed described their main teaching style as teacher directed. Although I went to the staff room for morning coffee while visiting the schools to conduct observations, I was never formally introduced to other members of staff, other than the IT coordinators, and no one ever inquired about what I was doing in the school. Unless I initiated conversation with teachers no one made the effort to talk to me. Neither principal ever joined their staff for the morning coffee break in the staff room while I was there. In school one staff room conversations seemed to be dominated by the latest escapades from the most difficult children and I found the overall atmosphere there dreary and depressing. In school two the staff room atmosphere was more cheerful and relaxing, although one could detect a lack of cohesiveness among the staff as a functioning unit.

Home/School Liaison

All three site one schools have a strong tradition of Home/School liaison. There is a full time dedicated home/school liaison support (HSCL) teacher in each school whose sole responsibility is to strengthen links between the school and the parents so that parents can feel part of their childrens' education. To facilitate this process each school has a parent drop-in room where coffee mornings are regularly hosted and the schools also offer training courses free of charge for all parents in areas such as basic literacy, art and crafts, , aerobics, and since the advent of WFL, Information Technology. In addition HSCL teachers regularly visit parents in their homes, particularly the parents of at-risk children and keep all parents informed of school events and activities through the production of regular newsletters which are distributed to all homes. The HSCL support service is by all accounts an excellent initiative, which works very well for these schools and they are proud of how well it operates and the efforts they have made in getting it to work.

One of the spin-off benefits of the WFL project is that by virtue of the sizeable investment in infrastructure, the schools could offer basic IT courses for parents

under the home/school liaison umbrella. Both school one and school two blocked out one morning a week in the computer lab for the delivery of IT training courses for parents. An external trainer from the local Adult Education center was brought in to deliver these courses. There was a good demand for the courses which could take up to twenty-five participants at a time. Most of the participants were mothers. At a meeting which I attended of the Wired For Learning schools in September 2002, one IT coordinator informed me that demand for IT training from parents was still high and that there was even a waiting list for those now wishing to enroll. She also informed me that some of the parents who had done the first IT Training courses in the school had subsequently gone on to do more advanced computer training at the local Adult Education Center.

The provision of IT training courses according to the principals and the Home/School Liaison personnel on whose behalf the principals spoke, was seen to have strengthened home school links. In the first instance it provided some parents, particularly mothers wishing to return to work with an opportunity to acquire new skills relevant to a changing marketplace. Secondly, coupled with open days whereby they were encouraged to visit the school labs during school time to see their children interacting with computers, it gave them the chance to participate meaningfully in this aspect of their children's education. In this respect one Principal commented:

"Since we have become part of WFL we have made a big thing about parents coming to visit our computer room to see what we and the children are doing and to enthuse the parents. A lot of difficulties for parents particularly in a disadvantaged area is they feel they are not able to help. So this is another way for parents to share in their children's education. I am very enthusiastic about that."

Although quite enthusiastic about providing IT training for parents, I was surprised that neither school had made any attempt to provide WFL specific training for parents, I was also surprised by the fact that although both principals and subsequently some teachers when interviewed, highlighted the fact that as more parents were now working as a result of the Celtic Tiger and consequently were not

as free to visit the schools during the daytime, that these and other courses were provided during day-time hours.

History of Computing

Of all the participating schools in this research, schools one and two were the least IT proficient prior to their involvement in the WFL project. In fact they were virtual novices as their computing history indicates.

In the case of school one they acquired their first computers about two years prior to the WFL project when they received a donation of computers from a local supermarket chain. Some of the staff then expressed an interest in developing IT skills and the staff as a group decided to avail of evening IT courses for teachers. Eighteen of a staff of twenty four attended a ten week evening course during the 1998 spring term. Around this time the school had accumulated £3,000 and the Principal circulated a number of local companies asking them to provide matching funding so that he could purchase a number of computers. The only company who responded was IBM who agreed to donate four brand new computers to the school and to supply three machines, ex-Vat at a £1,000 a piece. There was no mention of WFL at that stage. A friend of the school also donated another machine.

This meant that the school now had eight high quality PC's and the principal then approached the Board of Management for an additional £1,000 to purchase one more machine. As a result he could now allocate a machine to each of the nine fifth and sixth classes in the school. Although pleased with this development, he soon became quite disillusioned when he discovered that the machines were sitting at the back of classrooms, to a large extent unused. So for the following year, he got an agreement from his staff that the machines would be moved between classrooms so that the third and fourth classes would use them on alternate weeks. At the same time, the school appointed its first full time IT coordinator, under its extra resource allocation post which it had by virtue of its 'disadvantaged status'. It was at this point that IBM approached them in relation to the WFL project.

The situation in school two was quite similar. They acquired their first computers in September 1998 when they received a donation of three Acorn computers and two Apple Macs. In January 1999 an additional three PC's were donated to them by local industry. Although resource poor at this stage they were in the process of developing their own IT plans before the WFL project arrived. As a school they had already appointed a full time teacher to the role of IT coordinator under the extra resource post allocation. As the principal and IT coordinator confirmed to me at a meeting in March 2000, the arrival of the WFL meant that in terms of their IT development and plans, they had to fast track very quickly along a steep learning curve.

Assessed in pure technology terms alone, these two schools had to make a quantum leap in taking on the WFL project. It wasn't just that their hardware acquisition to date was basic, fragmented and piecemeal, but also the fact that there was no one on staff who could be classified as having an above basic knowledge of computing.

Enter WFL

It's not an exaggeration to say that the arrival of the WFL project with its sophisticated infrastructure brought these schools from the computing stone-age into the modern-day E-environment. As one teacher commented "This project has brought us right slap into the technology age."

As part of the project the two schools received twenty-four multimedia PC's each. School one put fifteen PC's into the main lab and distributed the remainder throughout the school so that each classroom also ended up with it's own PC and printer, apart from those located in the temporary pre-fabs. Teachers here used the two IBM laptops for use in their classes. School two put fourteen of these into the main lab and distributed the remainder throughout the school. As a consequence of the PC's they already had this meant that each classroom now had it's own PC. They also allocated two PC's to the two learning support teachers, one to the Resource teacher for travelers and one to the early start program. A PC was also installed in the principal's office and in the main office. Printers were also installed in every classroom.

Given the nature of the project, particularly with its emphasis on establishing new means of communication and collaboration between schools and parents I was surprised to discover that neither school put a PC into the parent drop-in room which also functioned as the office of the HSCL teacher. Equally surprising is the fact that neither HSCL teacher was invited to attend or even encouraged to attend the Wired for Learning training courses, and consequently they never received any formal training on the software.

The schools in both labs were bright, spacious and airy rooms. The laminated tabletops, typist chairs and the up to date multimedia PC's gave the labs a smart, professional look and feel. Both labs were laid out in a similar style, with the teacher's desk and whiteboard at the top of the room and the computers perched on benches located on the rooms two side walls. This meant that the children faced towards the walls when they worked on the computers and there was ample space in the middle of the floor for the computer teacher to move around and between each child as he or she worked. The server, patch panel bays etc. were located in a comms cabinet at one end of the room, adjacent to which a colour laser printer was located.

One serious technical issue which affected only these two schools in the project concerns their network connectivity. The original configuration model envisaged that all three schools in site one would have a high-speed leased line connection to the internet. It was planned to install a leased line in school five and extend this across to schools one and two. However because of the distance between the school five and the other two schools, the costs proved too prohibitive. A number of alternative technical configurations were proposed and after months of deliberation it was decided that the most cost effective method was for schools one and two to install an ISDN line each which would be connected into the server in school five from where they could access the WFL software and the internet.

WFL Infrastructure

Schools One & Two

Description	Details	Quantity
Server	IBM NETfinity 500, P11350/100, 512KB, 64MB Open BayTower Netfinity 128MB SDRAM ECC RDIMM Netfinity 9.1 GB Slim High 10K RPM Ultra Wide HS IBM Netfinity ServeRaid -3L Ultra2 SCSI Adapter IBM 12/24 DDS3 4mmInternal Tape Drive -SCSI NETfinity Two-Drop Internal SCSI Cable Smart UPS 1400i floor model G54 15" Stealth Grey (Black) Monitor	1 5 1 1 1 1
Aptiva Multimedia PC	Micro Tower (2x4), PCI/ISA Processor Type: AMD K6-2 with 3D Now Technology 333 MHz (x) Memory - standard 64MB/maximum 256MB Disk Capacity: 8 GB	24
Cabling	IBM ACS Structured Cabling	40 Drops
Laptop	Intel Pentium processors with MMX technology at 300 MHz large TFT active matrix display. Highspeed CD-ROM drive, 4.3 GB hard disk drive. PC Card modem.	2
Internal network	High speed network connecting 32 workstations and existing network to WFL server	
Internet Connectivity	High speed ISDN Connection to leased line in Community School Internet Service Provision for two years	

Figure 23

The net effect of this situation was that while all of this was being deliberated upon these two schools had no external communication connection to the outside world or the internet, for the entire academic year 1999/2000. The level of frustration which this caused was best summed up by one IT coordinator who said to me one day when I was visiting the school: *"Here we are in this wonderful communications project and we must be the only two schools in the country not connected to the internet. Myself and the other IT coordinator feel we're on our own little island and we communicate by running across the yard to each other. It's hilarious when you think about it...."* (observation notes 12/4/00)

To add insult to injury, when it was finally agreed to run with an ISDN connection, the schools were told they then had to apply for funding and make a case to justify why they should qualify for an ISDN line. The principals were unimpressed by this petty bureaucracy. As one principal explained to me *"surely being part of the Wired*

for Learning project is justification in itself. This is unnecessary, time wasting and very annoying". (observation notes 7/3/00).

The IT Coordinators

There were many similarities between the IT coordinators in the two schools. Both were female, similar in age and were senior staff members with over twenty years teaching experience behind them. In terms of their teaching styles, based on my observations in their respective computer labs, they both adopted a teacher directed, whole class approach to teaching. Prior to the commencement of the project neither had much IT experience and were appointed to the IT posts by virtue of their senior positions in the school and their willingness to take on the job which in effect brought them a promotion as the IT post was categorised as a 'Post of Responsibility'. Their lack of IT experience did not deter them from adopting a thoroughly professional approach to the job, and given the low skills base that they started from, they did an excellent job in maintaining and administering the network, identifying suitable software, running the computer laboratory, delivering ICT lessons for students, training and supporting teachers and managing and running the WFL project.

The problem was that they seemed to be doing everything with very little engagement with what they were doing from other staff members apart from the principals who were very supportive of them in terms of the WFL project. A large part of this can be attributed to the fact that the IT posts in these schools were designated as full time posts whereby the duties assigned to the IT post holders were classified as fulltime ICT duties. This contrasted with other schools featured in this research whereby the IT post holder, even if he/she held a Post of Responsibility, was assigned to ICT duties in a part time capacity while still being required to do standard classroom or subject teaching for the remainder of the time. The danger of the full time IT teacher model, which had become quite apparent by the time I visited these two schools, is that it encourages a culture of dependency on the IT coordinator and lets other staff members off the hook in terms of getting their hands dirty with the technology. This is an unhealthy development, which effectively

militates against the development of ICT as a cross curricular tool, which is where many researchers and policy makers maintain the true role for ICT in education lies.

School Visits and the nature of Computer Use

When I eventually negotiated research access to schools one and two, it was on the understanding that I would confine my observations to the computer labs only and that I would conduct these observations on one agreed day per week, at a time and day convenient for the IT coordinators. It was also agreed that these observations would be conducted for a maximum of six weeks. Both schools were also keen that I would concentrate most of my research endeavours on examining the use of technology in the schools from the broader perspective of the use of ICT in education rather than looking specifically at their use of the WFL platform.

In all I conducted five separate computer laboratory observation sessions at each school over the period February to April 2000. For continuity purposes I endeavoured to observe the same classes over the period although occasionally this had to be altered. In the case of school one, each observation session lasted for one hour and twenty minutes during which time I observed two separate classes in the lab. In school two, each observation session lasted for two hours during which time I observed three separate classes. Between the two schools I ended up observing the following classes:

Junior Infants (age group 4-5)

Senior Infants (age group 5-6)

2nd class (age group 7- 8)

3rd class (age group 8 - 9)

4th class (age group 9 -10)

5th class (age group 10 -11)

In both schools each class was allocated a 40 minute computer class per week in the school laboratory. This meant that every class was taught by the IT coordinator, who was seen and known as the computer teacher. Both coordinators adopted a teacher directed approach to their respective lab lessons where maintaining discipline was

very much the order of the day: In school two the class teachers stayed in the computer lab with their classes for the duration of the lesson and for the most part performed the role of classroom assistants while there. The only exception to this was with the 2nd class pupils where the computer teacher only took half of the class at a time, where she concentrated on teaching them word processing, while the other half stayed in their classroom with their class teacher.

Based on my observations which was subsequently confirmed in the interviews with teachers from school two, the model adopted by school two was beneficial for both teachers and pupils at this early stage in their computing development. Teachers reported that they too and not just the pupils were learning a lot from the IT coordinator during the lab lessons which was helping to build their confidence with technology. Some teachers also reported how they were attempting to integrate what was covered in the lab with subsequent classroom work.

"The computer lab is great... I find it very useful in that if they work on a game in the computer lab, then when you come back you can give them more time on it in the classroom and you don't have to tell every single child individually how to do it. It's a good introduction to games and activities on the computer".

Teacher 1, School 2

"I feel that having a dedicated IT lab teacher has been good. I wouldn't have felt confident enough in September to say to the class o.k. switch on your computers this is how you do it, so just the fact of being in the lab and helping the children to get to know the software has worked out great. So I'm glad there was someone there to show me. I know down the line I'll be well able to use it myself, it's just getting used to it".

Teacher 4, School 2

I found insights like these encouraging and they tempered somewhat, although they did not completely allay, the concerns which I initially developed based on my observation data, about the fulltime IT teacher model and the emergence of a dependency culture. I was dismayed therefore to discover while conducting the research interviews that the IT coordinator was considering changing the model for

the forthcoming academic year (2000/2001) for all classes to one where she would take only half the class to the lab at any one time while the remainder would stay with their class teacher in the classroom. I considered this to be a retrograde step which would not augur well for the future development of ICT as a cross-curricular tool in the school.

The situation in school one was also problematic. For the most part teachers either did not stay in the lab or stayed only for a short while to log on to check their emails or their WFL accounts and they did not engage with what was going on in the lab lessons whatsoever. As the IT coordinator commented:

"This is my first year and I think the lab has worked well this year. I think the whole model in the future probably will be a bit different because this year I've been the one doing all the teachings and the teachers have just come down to (1) accompany the class and (2) do their own work on WFL, but they haven't really got involved with the lesson."

Not surprisingly therefore, in the course of the research interviews teachers in school two reported very little integration between lab work and class work with most indicating that the classroom PC was rarely used. A consensus opinion had emerged in this school that the PC was not to be used during 'core-subject teaching' as it was seen as too much of a distraction and a disruption. In this respect the principal commented:

"The challenge to us now is to integrate IT into the class. There is still a kind of mentality where teachers feel that it's another thing added onto the curriculum and while they appreciate the benefits of it, one of the comments people are saying is "well I don't want them doing it when I'm doing something important like a new concept."

I suspected he had an uphill struggle on his hands not least because all five teachers interviewed reported that their predominant teaching style was 'teacher-directed'. Therefore I think it is reasonable to conclude that the predominant teaching culture throughout the school was predicated on a 'sage on the stage' model of teaching

which is fundamentally at odds with the view of the teacher as a 'guide on the side' which the computer has the potential to foster.

Nonetheless it was encouraging to note that at least both the principal and the IT coordinator were alert to the trends and dangers they saw emerging and were conscious of the need to make adjustments to their existing model. As the IT coordinator explained:

"To date I've been the one engaged in the lessons in the lab, so I think maybe for next year I am going to try and engage the teachers a bit more so that eventually they will be qualified to bring the classes down and do their own lessons in the lab.... I know that with me still being here that some teachers will use that to say "oh it's not important that I have something prepared."

Discipline in the Lab

As an observer of the IT classes in both labs, I was struck by the high level of discipline which was maintained by the IT coordinators. In contrast to other schools where I also conducted computer lab observations, the children in these two schools were highly regimented both in terms of how they were expected to behave in the lab and in how they were allowed to access the machines and the software. In school one where the children were that bit older, the children walked quietly to their computer terminals on entering the lab. I wrote in my reflective diary that during the class "the children never left their seats, never wandered around and never walked up to the teacher to attract her attention. They simply put their hands up and waited until the teacher got around to them". I also noticed how quiet the lab was even though the children were working in pairs.

In school two, where the children were younger, the children walked into the lab with their fingers on their lips and quietly took their seats. "No talking please" the teacher would remind them as they took their seats. The class always began with a roll-call and on leaving the lab the children formed into line on the basis of a numbering system which the IT teacher had allocated to them. Anyone who joined the line out of turn was reprimanded. By her own admission the IT coordinator said

to me that she thinks the children find it difficult in the computer lab as they have more freedom in their own classroom where they are allowed to roam more freely but she feels that you can't allow that in the lab as "*you would get nothing done*". (Obnotes: 29/3/00).

My impressions were that this level of discipline was not confined to the IT labs but was reflective of an ethos of discipline that pervaded the schools. In fact I was so surprised by how well "behaved" the children were in the lab and how quiet they were that I actually mentioned it to one of the IT coordinators during an observation visit to the lab conducted on 2/3/00. As she explained :

"We put a very big emphasis on discipline in this school. We have to, otherwise the kids would go absolutely crazy. I mean you'd want to see them when they are not in class, you just wouldn't believe how wild they are – they're just wild out. So we have to keep a tight rein on them in school and for the most part they are very well behaved when they are in here."

In both schools the IT coordinators always locked the computer rooms whenever they went for breaks so children were never free to use the labs unsupervised.

I have to admit I felt ill at ease with the level of discipline that was displayed in both labs. My sense was that it militated against the more progressive view of the computer as a pedagogic tool for enhancing the quality of education provision by facilitating exploration, creativity and independent learning. In my opinion it is very difficult for these attributes to flourish in such tightly martialled environments as I witnessed in operation in schools one and two. It certainly raised questions in my mind about the quality of ICT education as experienced by different students from different socio-economic backgrounds. Even though the WFL project had created a level playing field in terms of ICT infrastructure and access for these disadvantaged students, the conditions under which their exposure to IT access took place was quite different from that of their more affluent counterparts in the other research schools. Perhaps most pertinent of all my observation comments in this respect is one I made on my final visit to school two (5/4/00) where I wrote in my reflective diary at the end one computer class that "*unlike the children in school six, none of the children*

express disappointment when the teacher calls an end to the computer class nor do they ask if they can stay on”.

Children's interactions with the Computer at School One

During my lab visits to school one, the classes which I observed were using a software package known as 'Storymaker'. As its name suggests, the package is designed to encourage creativity by providing students with the opportunity to create and develop their own stories, characters and plots. The package comes complete with a range of multimedia accessories such as clipart, animation and sound files which can be incorporated into the story. Bubble boxes, similar to those found in comic books, which the children create, contain the character dialogue. Although it only facilitates the development of linear narrative, it is a useful package for encouraging the development of narrative creativity with young age-groups and it is a fun package to use. From my observations a number of things stood out:

- Although the children worked in pairs, they worked mainly in single sex pairs. This seemed to influence their choice of imagery when it came to clip-art selection. For example I noticed that although the children in the 3rd class were working on a holiday story based on a camping or seaside theme, the clipart images which the boys chose were dominated by trucks, motorbikes, aliens, soldiers and police. This is not exactly the type of imagery that one would usually associate with a camping or seaside holiday. The female clipart selections were far more realistic featuring things like caravans, deckchairs, sleeping bags, barbeques, children's toys such as teddy bears and dolls houses and even 'granny'. In the few instances where boys and girls worked together, scenes contained a combination of both types of images in which soldiers and motorbikes also featured, but more as background props than as centre stage characters.
- Despite the fact that the children were working in pairs, there was very little discussion between the children as they worked and hardly any planning took place. For the most part children were engaged in turn-taking exercises as they worked on the PC and it would be difficult to categorise anything that I

observed as 'collaborative learning' in the true sense of the word. During one session I made the following observation in my notes:

I was fascinated watching one set of girls work. One student was obviously very bright while the other student was quite weak. The weak child used the computer the entire time while the bright student directed the whole operation – told her what clip art to get, where to place it in the scene, what to type etc. Visually the bright student was very good. She had a great sense of perspective. For example when they imported a tree from the clipart and placed it initially in the foreground and then decided to move it to the background, while the weaker child just wanted to leave it there and bring in the next image, the brighter child instructed her to make it smaller and directed the image reduction process until she felt the tree (dimension) was just right for its placement in the image. However she didn't articulate to the weaker child why she wanted it done like this. Nonetheless I could see how her mind was working. If properly directed, spotted and nurtured this brighter child has the potential to become a film maker at a producer/director level or even a multimedia producer as she grows up. Given the disadvantaged community in which she lives, I doubt however if this side of her ability will ever be properly nurtured.

(Obnotes: 24/2/00)

- The teacher evaluated and praised the children's work based almost exclusively on its literary merits such as words or spellings. Although the visual and narrative continuity in many stories was lacking, this was never commented on and no attempt was made to develop a sense of storyboarding which is so important to the development of visual narrative. This was brought home to me quite forcibly at one observation session (2/3/00) with the 5th class group while observing the teacher checking the work of two students. In the bubble box, the children had created an unfinished sentence with a number of dots at the end of the sentence to indicate to the reader that they needed to move to the next screen to find out what happens next. Despite their explanations to the teacher that this is what they were attempting to achieve, the teacher gently but firmly insisted that they finish out the sentence and put in a full stop. It seemed to me that the teacher didn't appreciate that within the context of visual narrative i.e. films, comics, drama and multimedia, it is quite acceptable to use incomplete lines to create suspense and a heightened sense of drama.

I think these incidents illustrates the extent to which the teacher overemphasized literary and linear thinking skills traditionally associated with academic learning at the expense of the more creative skills which a multimedia package like Storymaker can inculcate. Such an approach, in my view, potentially constrains the pedagogic value of students ICT usage and engagement from both an experiential and developmental perspective.

Children's interactions with the Computer at School Two

During my lab visits to school two, the classes which I observed were mainly using the software packages 'Mighty Maths Carnival' and 'Animated Alphabet'. Other packages which I observed in use were 'Matty Mole', 'Thinking Things' and 'MSWord.' The first two packages belong to the 'drill and practice' genre while 'Matte Mole' and 'Thinking Things' have a more problem solving orientation.

Given the disadvantaged background of the children, the drill and practice software was seen to have a role to play in aiding the development of the children's literacy and numeracy skills. Nonetheless, the IT coordinator was aware that they were facing an uphill battle on both fronts. On the whole, she rated the literacy skills of the children very poorly as a consequence of parents not reading (or being able to read) to their children. *"No matter what we do in school"* she said to me one day *"we can never make up that literacy gap that arises when parents don't spend that ten minutes everyday reading with the child"* (obnotes 15/3/00). Similarly she acknowledged that many children experienced problems when using the 'Mighty Maths' package in the lab mainly because they have "no number or recognition skills". She also felt that the children had poor listening skills and commented that *"kids simply don't listen anymore"*.

From my observations a number of things stood out:

- Possibly because the children were so young and therefore so vulnerable, one got a very good insight into the level of disadvantage of the children and the extra demand that this places on teachers. A number of children had emotional

and learning difficulties and in one class alone three children were in foster homes, awaiting adoption and in the case of one disruptive child in the lab, she was already in her third foster home since the commencement of that school year. In another class a troublesome child who has been recommended for a special school was caught up in a custody battle and he couldn't be moved onto the special school until the custody issue was sorted out.

- The lab presents the teacher with many organizational and management challenges, particularly when dealing with very young children in class groups of twenty-five plus. Issues abound in relation to getting each child seated at their terminals, opening up the correct software package, turn-taking and keeping children focused on the task in hand. In this case the teacher resorted to a highly regimented, disciplined, teacher-led approach to assist her in organizing and managing each session, but even with the class teacher assisting her and in some cases even the researcher lending a helping hand, it was obvious that the IT coordinator was pushed to the limit in terms of trying to maintain a productive and useful session. Many young children appeared to need a lot of help and individual guidance while working with the computer. Furthermore the ethos of discipline which pervaded the lab meant that brighter children were not encouraged to move ahead through the software nor were they encouraged to help other children out. In fact quite the opposite as this incident from my observation notes illustrates:

"The teachers scolds one boy who has been attempting to help out some of the children beside him who have asked him for help. They had become impatient waiting for the teacher to get round to them to sort out their problems. "X", you have enough to do on your own without adjusting anyone else's," the teacher reminds him, - "that's what I'm here for".

Obnotes (15/3/00)

- As was the case in school two, children working together did not work collaboratively. The younger the children it seemed, the less inclined they were to even take turns. Inevitably one child tended to take control of the mouse and

the keyboard and refused to relinquish that control until instructed otherwise by the teacher on protest from the other unfortunate partner. Conscious of the difficulties the children experience working collaboratively, the teacher frequently reprimands the children for not cooperating together. "*I don't want to hear 'I'm making a house', it's 'we're making a house.' Do it together*", she tells one group.

- As I stood over the children as they worked and took notes, or videotaped them with a small digital video recorder, I occasionally took the opportunity to talk to them and asked them to explain what they were doing. The children were seldom able to explain exactly what they were doing or trying to achieve. In one observation session I recorded the following comments:

The 'Thinking Things' package is really challenging the children's logic abilities. I ask one of the children who has made a selection why he made that choice. He couldn't explain it to me. [I think that's because he's actually using guesswork rather than logic in trying to work it out]. I observe the boy next to him working. The program is asking him to choose the character that has big eyes or straight hair but not both. The child clicks away but doesn't get the correct answer. In fact he only gets the correct answer on the last one. Observing some of the children I notice that they really do not stop to look at the pictures on the screen. They don't examine the screen at all. They just seem to click away until they end up with the right selection either by guess work or a process of elimination. I also notice that when they are working through this logic section that they frequently misinterpret the 'or' for an 'and' statement.

Obnotes (22/3/00)

- Is the PC a suitable educational computing device for early learners? From my observations I felt that the PC as it is currently constructed is a clumsy and complicated tool for early learners to use. Both in terms of its physical design and software interface it is unsuitable for small children in a classroom setting. Watching the children interacting with the PC over a course of several weeks a number of features emerged which are worth highlighting:

- Young children instinctively point to and physically touch the screen when they see the choice they want to make. Having to use the mouse or the keyboard to make choices is cumbersome, distracting and time wasting for them. Touch screen technology would appear to offer a more natural and intuitive form of interactivity.
- Why are children in schools expected to use 'adult' machines that have been primarily designed for the business world? We design books with children in mind, create childrens' menus in restaurants and design toys which they can physically manipulate and have fun with. Why don't we do the same with children's computers? There's something very absurd about watching the tiny hand of a 5 or 6 year old child, juxtaposed against a mouse designed for an adult hand, or a small head straining upwards at a screen designed with adult dimensions in mind and physically located to suit an adult's frame rather than a child's frame. Even if one if just to look at it in pure ergonomic terms alone, there is a total mismatch between the machine and the physical needs of the child.
- Another interesting mismatch which the IT coordinator brought to my attention concerns the keyboard layout. She was quite critical of the keyboard because all the letters are in capitals. In her opinion this causes big problem for young children who do not recognize capital letters as they don't cover capitals until a later stage in the curriculum. To put this in context, the principal makes the point to me that they have often rejected very good textbooks on the basis that the typeset alone does not meet the correct standard and therefore could confuse the students. This raises the question why should schools have to 'lower' their tried and tested quality control standards to accommodate machine technology?
- Why are headphone and speaker sockets located at the back rather than at the front of PC's? Not alone is it most inconvenient for the average user, (ask yourself where is the headphone socket on your home stereo located or perhaps it's even a wireless connection?) but in a school it can prove to be quite a nightmare for the teacher to hook up headphones to all machines when using

multimedia software. As one IT coordinator commented to me one day while trying to connect speakers to the back of the machine – “*You’d need to be a contortionist around here*”. But why not just leave them plugged in permanently, one might ask? Well firstly there’s the problem of space. When space is at a premium and you want to create as much worktop space as possible for students, headphones lying on a desk create unnecessary clutter. Then if they’re easily accessible they can be a distraction for students who tend to fiddle with anything they can get their hands on. Last but not least there’s the problem of head lice. I must admit head lice is not something I would have thought of but it was a very real and serious problem for schools one and two. So serious in fact that both schools had decided to discontinue using headphones in the lab for fear of exacerbating the problem which the school already experiences with head lice. Being a disadvantaged school they were quite alert to the problem which sharing headphones could create, especially when the hygiene standards of many pupils are quite poor. I suspect that the issue of sharing headphones and the potential for creating a head lice epidemic as a result, will become a problem that all schools dealing with young children will have to address sooner or later. The obvious solution would seem to be for each child to have his/her own set of headphones to bring into school each day just as they would a pencil or pen. In such a situation the importance of having headphone sockets conveniently located on the PC goes without saying if mayhem is to be avoided.

- While it is useful for children to know how to use packages like WP and to understand the concept of word-processing, is MSWord a suitably package for young learners? Frankly I don’t think so. It’s too complicated for early learners because they are too many features attached to it. All they need are simple drop-down menus with limited choices to do what they require at this early stage of their development. Furthermore the automatic redlining that appears underneath a spelling and grammar mistake in MSWord is confusing for children, particularly when they are trying to use fictitious names when creating stories. Teachers need to be more judicious in evaluating software for particular age-groups and choose WP packages with a more intuitive and child-

friendly user interface. Packages like 'TextEase' and 'Creative Writer' spring to mind.

One of the major benefits of adopting an open and unstructured approach to observation studies is that it forces you to be alert to everything going on around you. My objective in conducting these observations was to try to gain an understanding of ICT usage in education and the dynamic of the learning environment when computers are introduced. By far the most useful insights I gained were those which highlighted all the little practical problems, which when viewed from a classroom perspective are really quite major hurdles that militate against the effective use of ICT in education. From where I stood, the technology still got in the way and I would argue that if ICT in education is to grow and prosper, computer manufacturers need to put a lot more thought into designing machines with a simpler and more intuitive interface. It is easy to overlook the fact that when it comes to ICT we sometimes think and talk about educational technology in an abstract and neutral ways and forget about the social context in which the technology has to be used. Viewed in this light the engineering and design logic that permeates computing and machine technology somehow seems at odds with the chaotic and messy world of child learners and the social context in which that learning has to be negotiated.

WFL Implementation

In terms of understanding the schools and their teachers responses to the Wired for Learning project, my information sources came primarily from attendance at WFL joint site meetings at which all the schools gave presentations on project progress, in-depth interviews conducted with project participants in both schools and information informally communicated to me during meetings with the school principals, IT coordinators and members of the project core team such as IBM and the SIP national coordinator.

It was clear that in both schools the principals and the IT coordinators worked very closely together in terms of supporting the project and rallying staff support for it. However, compared to the site two schools there did not appear to be an involvement of other key members of staff in the project at a strategic level. Not even the vice-

principals were actively involved and whenever project meetings were held, only the principals and IT coordinators attended. In the case of school two, I wasn't even aware that they were training a back-up system administrator for the IT Lab until I was conducting interviews and discovered quite by accident that the interviewee had been earmarked for this role, albeit in a specific technical rather than a broader project capacity. School one had not even progressed this far and consequently the role of the IT coordinator was a particularly onerous one.

WFL Focus Areas – School One

While school one made some usage of 'Home Pages' , 'Events@ School' and the 'Resources' section of the 'Instructional Planner' application, the two main areas of focus were:

- Teachers Lounge
- Team Projects

Teachers Lounge was used quite effectively to encourage online communications between staff on planning and policy issues. The principal and IT coordinator were particularly pleased with the schools use of this application to coordinate In-Service Planning days. They felt that it enhanced the quality of the proceedings because it encouraged greater preparation prior to the planning sessions themselves, greater participation in what was happening by all staff members, both of which in turn led to more meaningful and deeper discussions on the day. This was due to the fact that coming up to the planning days, members of the planning committee posted topics for discussion on the system and encouraged replies and suggestions from all staff. Then when the sessions were finished, policies drafted on the day were posted out to all for further comment and amendments. This was seen as enhancing efficiency as it eliminated the need to physically bring people back together for further discussion and agreement. At a presentation delivered to all five project schools at a gathering on May 11, 2000, the IT coordinator reported that the staff found the Teachers Lounge to be both 'user friendly and easily accessible'. These findings were also confirmed in the research interviews where the benefits were articulated as follows:

"WFL has changed the way we communicate because that's a big aspect of it and we are using it quite a lot to communicate. When we were deciding on policies or planning for our curriculum days, everyone got drawn into the discussions through using Teachers Lounge and everybody felt everyone else's opinions was very accessible to them, whereas in a staff meeting which is the other way we would normally have communicated policies, a lot of people don't contribute, maybe because they feel intimidated by the more vocal member of staff or maybe because they are younger and new to the staff, so we got more opinions and more discussion going this way".

IT coordinator

"I would have to say that the Teachers Lounge is excellent. Communicating from other teacher to the next is brilliant and it's great for passing messages on from the staff and for school messages. As a point of information it's great but you are limited to the amount of time that you can actually get on the computer".

Teacher 3

Team projects turned out to a less successful venture and teachers were disappointed with the outcomes. It was decided that the one year group would do a team project on 'Roman Life and History' while another year group would do a 'Write a book' project. The way it operated was that teachers placed assignments for students on the Team Projects section of WFL. The students responded by setting out what each group was doing. Throughout the project timeline teachers put in comments, advice and encouragement for the students teams while the students conducted online discussions with the teacher and other students about the project. The IT coordinator reported (presentation May 2000, *Appendix R3, Case Record, Volume 111*) that the students enjoyed the online communication and felt that it enhanced their projects. Teachers however were far less positive and felt that it took too much time for children to input material and that it was quicker and more efficient to respond in person to the children as they have constant contact with their pupils in class. They therefore felt that this facility was perhaps more suited to 2nd level students who wouldn't be in constant contact with a single teacher all day.

Fundamentally I think a large part of the problem which they encountered with Team Projects can be attributed to way in which they operationalised it. Instead of looking at the technology and asking – what can we do with this feature to enhance what we already do by doing something different, they simply tried to slot the technology into the existing framework. Naturally, teachers were absolutely right in their conclusion that it didn't make sense to electronically communicate rather than verbally communicate with students to whom they were class committed all day long. However if they had adopted a different approach and broadened their thinking to incorporate the development of cross-class team projects rather than just concentrating on 'intra class teams', I think the experience with this aspect of the innovation would have been more rewarding, , fulfilling and a lot more exciting for everyone, including the students. Instead however people felt disappointed with the results and unsure about the best way to use it, as the IT coordinator explained:

"We started the project in the way we do projects any other year. We always do class project so we decided to use Team Projects as an extra way of communicating and giving the children instructions and of course they enjoyed the fact that they were doing part of it on computer. But I think we were not using it very well and I'm still actually quite unsure about what's the best way to use it.....I think it probably is geared towards secondary schools and yet I feel that it has the potential to be a lot better."

WFL Focus Area – School Two

In terms of WFL school two had two main areas of focus for the year 1999/2000. These were:

- The Unit and Lesson Planning sections of the Instructional Planner
- The Resources section of the Instructional Planner

Their approach to unit and lesson planning was to adopt a thematic approach to the development of lesson plans. Their aim was to choose one theme per month to work on for each year class grouping. To facilitate this the teachers were freed from class duties twice a month so that they could work together on developing lesson plans. Substitute teachers provided class cover for them during these periods. This cover

was effectively paid for by SIP under the '45 days additional teacher time' which was allocated to the schools as part of the project.

By all accounts this was a successful venture as not only were 20 Thematic Lesson plans produced and posted onto the WFL system between January and May 2000, but it also provided teachers with an opportunity to work in teams and share their skills and expertise and to become familiar with the WFL software. In the course of interviewing most people commented positively on this aspect of the project. As the IT coordinator phrased it, *"this project has given us the chance to work together as adults.... and while we would have had a history of planning together we would not have lesson planned to the same degree or with the same kind of intensity prior to WFL."*

The approach to the Resources section of the Instructional Planner was to develop it for use as a School Online Library in order to make an extensive bank of resources in the school accessible online. To achieve this, category titles were changed in WFL's resources database to accommodate a range of different resource types such as 'audio visual and computer inventories', 'policy documents,' 'educational software,' 'worksheets' and 'schemes of work'. The IT coordinator, principals and post holders were mainly responsible for the development of this aspect of the project.

Sporadic usage was also reported of 'Home Page Creator', the 'Calendar of Events' and 'Teachers Lounge' but 'Team Projects', 'Mentoring' and 'Private Conferencing' had yet to get off the starting blocks by the time the researchers engagement with the project had finished.

School Five

School five was the largest of all the research school with a student population of 849 and a 61 strong teaching staff. Of these, 41 were female and 20 were male. From a research perspective it was also the school with which I had the least amount of contact and involvement. This was not for the want of trying on my part but had more to do with a reluctance on the schools part to participate in the research. It was the one school where I did not get the opportunity to interact with or interview the school principal. Nonetheless I feel that I gained sufficient research insights into the school through one school visit to the IT coordinator during which I also met the HSCL teacher, interviews conducted with a small number of teachers, contact with both the principal and IT coordinator at joint site meetings and information informally communicated to me by the SIP coordinators and IBM, to build an accurate portrait of the school's experience with and response to the WFL project. Having not had the opportunity to visit the schools IT labs to observe ICT usage in action I am not in position to make any informed comment on the nature of computer use, discipline in the lab or student interactions with computers. Consequently I will confine my case study portrayal to the Wired for Learning experience and other relevant data such as the schools computing history and the IT coordinator's role.

History of Computing and the IT Coordinator's role

I made two visits to schools five. The first visit occurred on May 22, 2000, a week before the school closed down for its summer holidays. The second visit took place a week later on May 29th to enable me to conduct research interviews with four teachers and the IT coordinator. While I would like to have conducted a larger number of interviews, I was very much at the mercy of what the school was prepared to or could offer to me for this purpose. Although never formally acknowledged, I got the impression that the number of teachers presented for interview was small due to the fact that not many people had responded to the IT coordinators request for volunteers in this exercise.

During the first visit, the IT coordinator outlined the schools history of computing to me and showed me the two main computer labs. The first of these known as the 'IBM Room' consisted of 24 multimedia PC's that the WFL project had brought to

the school. At the time of my visit there was a parents IT training course underway in this lab. The second lab was an older lab in which there were 30 PC's comprising a mixture of Dell machines and Tulip PC's running on a Novell network. This lab had been in operation since 1992 and was built with sponsorship from 3Com, one of the many multinationals with a manufacturing base in the local area. A number of years later these PC's were upgraded to a multimedia specification when the school received sponsorship from Creative Labs, another multinational with a local presence, to add CD-ROM drives to the machines. There was also a third lab in the school which I didn't get the opportunity to visit. This lab contained the remaining 12 PC's that the school had received as part of the WFL project. The focus for this lab was literacy improvement.

Between the three labs plus an additional four PC's located in the staff room and one other PC located in the Parents room, the IT coordinator was responsible for maintaining 75 teaching PC's and a 25 Gigabyte server, all of which were connected to a high speed leased line to the internet. This concentration of PC's into computer labs typifies the IT configuration found in the majority of post-primary schools where unlike primary schools very few PC's are distributed to individual classrooms.

Prior to the commencement of the WFL project, the school IT lab was used mainly with Transition Year students for the delivery of IT skills training in areas such as WP, spreadsheets and databases. These courses were delivered by the IT coordinator. As the IT infrastructure expanded with the arrival of WFL, the scope of the schools involvement in ICT was broadened to support the mainstream curriculum through the use of the web and the purchase of CD-Rom software titles for specific subjects. As the IT coordinator commented:

"The benefits of the project are immense and spilling over beyond Wired for Learning. Teachers are now using the web and other software for their daily work. So the project has helped IT integration even though there was some resistance to it in the beginning. But it's becoming the acceptable way to do things now".

WFL Infrastructure School Five

Description	Details	Quantity
Server	IBM NETfinity 5500, P11/400/100, 255MB Ram, Open Bay, Dual Raid, Tower	1
	Netfinity 9.1 GB Slim High Ultra Wide HS	5
	IBM 20/40GB DLT Internal Tape Drive –SCSI	1
	Smart UPS 2200i floor model	1
	G54 15" Stealth Grey (Black) Monitor	1
Aptiva Multimedia PC	Micro Tower (2x4), PCI/ISA Processor Type: AMD K6-2 with 3D Now Technology 333 MHz (x) Memory – standard 64MB/maximum 256MB Disk Capacity: 8 GB	40
Cabling	IBM ACS Structured Cabling	60 Drops
Internal network	High speed network connecting 40 workstations and existing network to WFL server	
Internet Connectivity	128 Kbps leased lined to Internet Service Provider for two years. Internet Service Provision for two years	

Figure 24

Unlike the IT coordinators in schools one and two, the IT coordinator had had a long history of involvement with ICT prior to the commencement of the WFL project. With approximately twenty years teaching experience behind her, she had a personal interest in IT and had done a networking course in Novell as far back as 1994 before networking had become fashionable. In 1995 she did a course in Web design at a time when it was necessary to do HTML coding to do even the simplest of web pages. She was also quite adept at a technical level and not afraid to take out a screwdriver to perform routine maintenance and repair tasks. She had been in charge of the lab and the development of IT in the school since the first lab was installed in 1992 and had over a number of years delivered IT training courses to the staff in areas such as word-processing, spreadsheets, the internet and e-mailing long before the NCTE's Teaching Skills Initiative (TSI) was established to promote teacher IT training.

The principal too was by all accounts quite IT literate and as far back as the mid eighties he had purchased the first computer for the school in order to streamline

school administration procedures in areas such as timetabling, the maintenance of student records, payroll and so forth. Although there was an element of serendipity about the development of IT in the school in that their first IT lab came about as a result of 3Com contacting them out of the blue in 1992 with a view to investing in a local school, the school rose to the challenge of this investment, and as a result incorporated IT development into the school plan from the mid nineties onwards. As a result even before "Schools IT 2000" and "Wired for Learning" came along they had already identified IT in education as an area of increasing relevance for their students and one which they wanted to develop further in the school. By 1998 they had even got as far as developing an IT target for the school for the year 2000 in which they had identified the modernization of their computer lab as a key target and to help them realize that plan they had invited a number of key local companies in, in a stakeholder capacity, to contribute to their school development plans. It was around this time that IBM contacted them and all other schools in the area about the Wired for Learning project. Naturally they seized the opportunity as not least among its attractions was the promise of a state of the art network comprising the latest multimedia PC's to replace their ageing fleet.

In their view IBM chose them as one of its WFL schools precisely because they already had a good IT set-up or were 'oven-ready', as the IT coordinator phrased it, and had plans in place for the future development of the school's ICT infrastructure. A combination of other factors as I have outlined earlier, also played their part but there can be no doubt that this was one of the key factors in the decision to award the project to this school and by association the two local primary schools from where the majority of its students came.

The arrival of the WFL project in the school substantially increased the workload of the IT coordinator. On top of all the project implementation duties and project management responsibilities, she now had to manage an extra two IT labs and more than double the amount of computers than heretofore. Under the terms of the project agreement the school was allocated .25 of a teacher, with equated to 25% of teacher time, to run the project. The principal, quite rightly went to battle with DES on this and put up a very strong appeal to have this time allocation increased. DES relented and consequently it was agreed that 50% of the IT coordinator's time would be

allocated to WFL duties. Effectively this meant that for the duration of the WFL project the school could employ substitute cover for half of the IT coordinators teaching timetable. As a result the IT coordinator had 11 hours off per week to devote to the project and performed normal subject teaching for the remaining 11 hours. It was still a huge workload and although there was another teacher in the school who was introduced to me as the assistant IT coordinator, she was quite a young and inexperienced teacher who didn't appear to have any substantive engagement with the project and the technology. On a number of occasions her responses to my interview questions were vague and uninformative as the following example illustrates:

Q. Have the teachers received adequate IT training for this project. Is it sufficient to give them the confidence they require?

A. What's the right answer here? I don't know. It's hard for me to answer that question because I didn't need any training. Maybe you should talk to someone with no IT experience about that.

Q. What do you think would have made this project easier to implement in the school?

A. I don't know.

Q. What will it take to make this project work in other schools

A. I don't know.

She did however make one telling comment in response to my question on the benefit of the networking system administration course which she recently attended when she replied that it would only be of use to her if *"I go to another school because I wouldn't get the chance to work on the network here"*. This revelation suggested that constraints were imposed on the extent to which she could participate in what was happening with IT in the school. This would be consistent with an off the cuff remark made to me from an authoritative source saying that some teachers in the school had complained that the IT labs were frequently locked and teacher access curtailed. It's interesting to note that the assistant IT coordinator who did not have a permanent teaching post with the school, resigned shortly after I conducted my interview with her, to take up a permanent teaching post elsewhere, where she took on the mantle of an IT coordinator's role.

Wired for Learning Implementation and Focus Areas

One of the things that struck me from my interactions with school five, limited as these interactions were, is that there didn't appear to be the same cohesion between the principal and IT coordinator in terms of supporting the project, as I witnessed at schools one and two. Unlike these two schools where the IT coordinators always accompanied their principals to the joint site project meetings, only one representative, usually the IT coordinator, from school five attended these meetings. Based on this observation and other triangulated data such as informal 'off-the-record' comments from the project core team, the one school visit conducted on May 22nd 2000, and the subsequent follow-up interview conducted with the IT coordinator, my sense was that when it came to implementing the WFL project, the IT coordinator was operating very much alone with little support from either the principal or fellow staff members.

This helps to explain why school five which on paper would have come across as one of the strongest IT schools and as a consequence, a school in which the project would have been expected to thrive, was one of the schools which struggled most with the WFL project and encountered very strong staff resistance. But it wasn't the only reason. Other factors such as project implementation issues, overly high expectations and hardware and software difficulties, which will be discussed at a more generic level in chapter seven, all played their part. It should also be acknowledged that local, contextual factors must also have had a bearing but as the researcher did not have the opportunity for 'prolonged engagement' at this school, it is impossible to discuss the extent to which these affected the project's implementation. Perhaps one day another researcher with more open access will shed more light on some of these. But that's for another day, another time and another researcher. I can only deal with the information at hand and in interpreting it, acknowledge the limitations within which that information was gathered.

For school five, the two key focus areas for WFL and the areas where it appeared to be enjoying the most success were:

- Home Pages
- Team Projects

In school five students were actively encouraged to create their own home pages. It was an activity which they enjoyed and found motivating and students regularly updated and changed their home pages on a weekly basis. The IT coordinator optimized the educational advantage of this activity by using it as a focus for improving student literacy by insisting that student home pages were word perfect before posting them on the site.

The Home Page feature was also successfully utilized by the HSCL teacher who used this facility to create a home school liaison web site for parents. The idea was to make this a source of information for parents whereby they could see the school calendar outlining school activities, days-off, staff meetings, exam timetables and other important school data. It also included details of parent classes in IT and WFL run by the school. Although home PC ownership was low, parents could access the website in the parents drop-in room which had its own PC. Furthermore the HSCL teacher had already been in touch with the local authorities, who were currently constructing a new library for the area, with a view to facilitating access from there to the schools WFL system for parents wanting to stay in touch with what was happening at the school.

Apart from the HSCL teacher and the PE teacher who made great use of the home page application to create a Sports home page in which details of sports events, teams and results were posted, most teachers were not too keen on creating home pages or regularly updating them. As the IT teacher explained, many teachers didn't like divulging personal details about their home life and outside interests in this way. To tackle this problem she tried to encourage them to create department home pages instead and was hoping to achieve better success by adopting this approach in the forthcoming academic year.

"It's interesting to look at the teacher home pages on the American sites and see their personal details. Now they say, 'I'm married to X, I have two cats, a tortoise and three kids. I drive this type of car, I'm spending Christmas with Y and so on'. Now that's absolutely out for our teachers, quite categorically they are not going to do it and won't do it. So I have found from my feedback with teachers that they are not keen on doing personal home pages but what they will do is a kind of home page about what they actually teach, around their job and around their subject. So what I'm doing now is encouraging them to do department home pages."

(Meeting notes, May 22nd)

Team Projects was utilised quite successfully in School Five, mainly with Transition Year students. A number of team projects were undertaken in different areas, some of which also incorporated field trips in areas such as 'Humane Farming', "Report Writing", Irish Film Studies", the "Easter 1916 Rising" and the "Millennium". During my school visit the IT coordinator showed me one very interesting team project that Transition Year students had undertaken on part time work, which included a survey of the school's senior student population participation in the part time labour market. At the time the issue of part time work time was a popular topic nationally as Ireland's booming Tiger economy was attracting many teenagers at an unprecedented level into part time jobs. This was a matter of concern for many educationalists and parents who believed it was having a negative effect on teenager's schooling at a critical time in the educational process. In a disadvantaged school, the effects of such developments are acutely experienced as many social and economic factors put pressure on teenagers to take up part-time work. For example out of a senior student population of 270 students, the survey revealed that 73% of students had part time jobs with over 50% of respondents working between 10-20 hours per week while 34% worked more than 20 hours per week. 40% of students felt that their schoolwork suffered as a result of working while 60% reported that it did not. Most interesting of all perhaps is that 68% of respondents indicated that they contributed money at home from their earnings with 81% of respondents indicating that their parents approved of them working.

Apart from the interesting findings, which are worthy of commentary in themselves but which are beyond the scope of this dissertation, what's most significant from the point of view of the Wired for Learning project is that it illustrates the extent to which this platform, when properly deployed, can be utilised to stimulate debate around issues of educational importance to the school population in which key stakeholders in the educational process i.e. students, parents and teachers can participate on-line. As part of the project the students set up a discussion forum using WFL's 'Talk@School' application to encourage parents to contribute to the discussion on part time work. When the survey was completed the results were posted online and they were also publicly displayed as part of a parents open night hosted by the school management to raise parental awareness around the problem of excessive part time working and its effects on students long term educational attainment. It is clear from the IT coordinators presentation to the joint site meeting in May 2000 that students enjoyed doing team projects and that it provided them with opportunities to work together and encouraged peer learning as students read each others work and compared it to their own.

While Home Pages and Team Projects were the key focus areas for the school, other applications within WFL were also being actively used. The IT coordinator reported that students were making good use of the 'Talk@ School' application to initiate chat room discussions on areas of interest to them such as music and the forthcoming graduation ball for school leavers. 'Talk@School' was also used to encourage parent discussion and debate around the problem of drug-taking.

Both the IT coordinator and HSCL teacher were keen to use technology to involve parents and consequently had organised basic IT literacy courses which were held for two mornings each week for parents and WFL specific training courses were run for them also. A PC was also installed in the parents drop-in room to encourage parent participation in online forums on WFL and as mentioned earlier the HSCL teacher was working with the local library to extend WFL's reach out into the community and to facilitate more convenient parent access. In addition the HSCL parent homepage hosted a guestbook section where parents were encouraged to comment on the IT training and the WFL project. As the HSCL teacher informed me there had been over 60 hits to the HSCL home page since they had set it up and many parents

had commented positively on the IT classes, the WFL system and IBM. It is clear that the HSCL teacher appreciated the potential of WFL to extend and enhance the positive relationship which existed between the school and parents in supporting children's development:

"It is also a vehicle for communication. Now that is my philosophy of it all. I see it as a vehicle for communication between parents and young people because young people are very much into computers and IT. So I think that if mum and dad are going home and saying 'I learned to go onto such a website today or we sent an e-mail out to X', I think that doesn't do any harm at all in terms of opening up communication between parents and children. That's another plus from it that I can see".

HSCL Teacher (meeting notes, May 22, 2000)

He was less keen however about WFL's Instructional Planner application, which was another feature that the school had attempted to use on a pilot basis with the English department. For reasons which I will discuss in greater detail in chapter seven at a more generic level, this was the least successful part of their experience with the system.

Conclusion

In summary then school five was quite ambitious and adventurous in its approach to the WFL project. The downside however is that while there was a lot happening with it, it was quite obvious that much of the impetus behind what was being achieved lay solely with the IT coordinator who appeared to be operating with little support from the school principal or other members of staff in driving the initiative forward. This isolation in my view would have detrimental effects for the project's success and sustainability over the long term in this school.

Section Three

Case Studies: Site Two

Introduction

Site Two comprised two schools, a primary school (age group 4 –12) and a secondary school (age group 13-18). They are typical of many Irish schools in that they were founded by a religious order of nuns in the mid nineteenth century and the schools were initially located on the convent grounds. The principals in both schools are nuns, a tradition which stretches back to the foundation of the first school in 1851. Today the two schools are located adjacent to each other, within a five minute walking distance from the convent and most children from the primary school transfer directly to the secondary school on completion of their primary education.

The schools are based in an historic port town, located in the far south of the country in County Cork. The population of the town is approximately 10,000 and the town is probably best described as semi-urban. Historically employment opportunities have been good as Ireland's second largest city, Cork, is a mere half hour journey away. Consequently those not employed directly in the local shipping and port economy, have readily found jobs in the city predominantly in skilled trade and craft industries. In socio-economic terms the majority of students come from homes which would be classified as skilled working class. About 30% of the student population fit into the disadvantaged category, a number not considered high enough to qualify the schools as disadvantaged schools and therefore as a rule they don't qualify for extra resources.

Both schools joined the WFL project in March 1999, almost six months after the site one schools. At this stage, the project definition document and statement of work had already been drawn up and consequently the site two schools had no input into its formulation. The decision to designate these two schools as the second WFL site is an interesting one in which both political and local factors appeared to have played a key role.

In the first instance, it was decided early on in the project's history, when IBM and DES were in initial negotiations that the second WFL would be based in Cork. Although no one has overtly said so, and indeed much of what transpired during those early negotiations is confidential to both IBM and DES, it is my conclusion that the choice of Cork was a politically motivated decision. The constituency of the then Minister for Education, was based in Cork and knowing the extent to which local politics in Ireland frequently influence national decisions, I think it's reasonable to conclude that the Minister would have been keen to ensure that a prestigious high profile project such as WFL should be based either in or close to his constituency.

Secondly, the secondary school made an application to the NCTE to run a SIP project in its school. As it transpired the SIP project which they were proposing centered on the Internet and the professional development of teachers, so there was a natural affinity between this project and Wired for Learning. Through the SIP national coordinator, who was on red alert to identify a suitable Cork site for WFL, this project was brought to the attention of IBM and DES and it was decided that IBM and the SIP national coordinator should visit the school with a view to finding out if they would be interested in taking on the WFL project instead. The school was delighted with the offer, could see its potential in terms of the school's ICT development and once it was discussed with the staff, who for the most part were enthusiastically behind it, it was decided to go for it.

The Wired for Learning model however dictated that a site must constitute a primary and a secondary school. This meant that a local primary school also had to be identified. Naturally the school next door was the obvious and logical choice. But this wasn't straightforward because the primary school, who were unaware that the secondary school had applied for a SIP project, had already taken a decision as a staff not to apply for a SIP project. This decision was prompted by the fact that the school was at that time already involved in another DES pilot project which involved the introduction of foreign language studies to 5th and 6th class pupils. As a result the staff collectively decided they had enough on their plate and that if they took on a SIP project, the bulk of the work would fall on the IT coordinator's shoulder and that would be unfair.

At this stage 'politics' intervened again. Apparently the Minister for Education had recently visited the primary school as a result of an earlier invitation extended by them to him to participate in an Italian Day which they were running as part of their foreign language pilot project. Although he couldn't attend that particular function he promised the school that he would pay a visit sometime soon, which he duly did. During this visit he was shown the schools existing computer room and was quite impressed by what he saw. It would seem that when it was brought to his attention that the school was having reservations about signing up for the WFL project, a senior department inspector was duly dispatched to the school to persuade them otherwise. Around the same time, IBM and the SIP national coordinator organized a presentation for staff and parents to explain the WFL project in greater detail and outline the potential benefits from participation.

Although, as the IT coordinator outlined in her project progress report of January 4th 2000, it was evident that there would be considerable advantages to participation in the programme, staff still had lots of concerns about the amount of time involved and the expertise required to run a project on this scale. It was only after careful and considered discussion and reassurances from IBM and NCTE regarding training and technical support that the staff finally agreed to participate in the Wired for Learning project.

It is clear from this background information that the manner in which the site two schools were selected for the project was quite different from that which operated for the site one schools. At the very least there was extensive consultation with the staff and with IBM and the NCTE before they agreed to take the project on board, even if the primary school could be at best described as a 'reluctant' volunteer in this whole process. But at least they were afforded the opportunity for debate and discussion which was a lot more than their counterparts in the site one schools had received. It is clear that the manner in which schools were selected had an important bearing on how the project developed in different schools across both sites.

Reaction to Proposed Research

Unlike the site one schools, both site two schools were most facilitative and helpful when I contacted them initially about participating in the research. This level of cooperation and helpfulness continued throughout the duration of my involvement with them. When I made the first phone call to the school in mid November 1999, to speak with either the principal or the IT coordinator, I was surprised that I was put through straight away to the IT coordinator. I later discovered on visiting the school, that the primary school had phones installed in every classroom. This is quite unusual in the context of Irish schools. A number of things struck me from this initial phone call and these were:

- The level of enthusiasm of the IT coordinator about the project and ICT generally
- The emphasis which she put on the close liaison that existed between themselves and the secondary school on this project
- The fact that she advised me to 'stick to protocol' and to speak to the school authority figures i.e. principal or vice principal before she would discuss the project in any great detail with me. To facilitate this process, she put me through to the vice principal immediately whereupon she gave me carte blanche to begin working directly with the IT coordinator for anything I needed.

The IT coordinator was quite keen for me to visit the school as soon as possible. However as the school was a four hour train journey away from my base, I did not wish to undertake this journey until I had spoken to the secondary school as it would be more beneficial to arrange to visit both schools on the same day.

Straight away therefore I contacted the secondary school to speak with either the principal or IT coordinator. The principal was away for the day and the IT coordinator was unavailable. I left a message with my contact details with the school secretary and I was pleasantly surprised when later on that evening, the IT coordinator returned my call. Again, like the IT coordinator in the primary school he was very enthusiastic about the project and willing to assist the research process in

any way he could. Interestingly though, he too advised me that I needed to first go through the 'official channels' before he could assist me further. So I contacted the school the next day and I was put through to the principal straight away. She too was very positive and suggested that I work directly with the IT coordinator from here on out to organize anything that I required.

Following on from this I then contacted both IT coordinators with a view to setting up a formal meeting. Aware that key project personnel from both schools were currently on as visit to WFL sites in the US, I suggested it would be best to postpone this meeting until they returned from the US. This was agreeable to all parties and a first face to face meeting with both schools was arranged for November 27th, 1999.

The First Meeting

The first meeting which was hosted in the principal's office in the secondary school was a joint meeting with key personnel from both primary and secondary schools. There were four representatives from each school comprising the two principals and their vice principals, both IT coordinators and assistant coordinators. This pattern was repeated throughout the project phase as I noted that there was always at least three representatives from both schools at joint site project meetings. The meeting which lasted for two and a half hours and which was conducted in an informal manner, during which I mainly listened and took notes on what they had to say, was informative, open and friendly.

Like the first meeting with the site one schools, this meeting was extremely useful in that it gave a clear insight into the current status of the project and some of the issues and difficulties that had surfaced to date. A number of interesting points were raised during the meeting, the key ones being:

- The importance of principal support for the project's success. The principals were praised for the level of support they gave to the project and the IT coordinators. The principals in turn praised the time, effort and voluntary commitment of the IT coordinators both in terms of project start-up and on-going development of the project.

- Both principals were of the view that the project required (a) one centrally committed person such as the IT coordinator and (b) one anchor support person such as the assistant IT coordinator.
- The amount of time, commitment and voluntary effort required from all staff in supporting the project initiative, particularly when it came to doing IT training after school hours. There was a certain amount of annoyance expressed in relation to this huge voluntary effort which they felt wasn't been adequately recognized by the Department of Education and Science, IBM and the NCTE. As one person phrased it "they haven't a clue as to the amount of extra hours it takes". Concern was expressed in relation to the long term viability of the project if this huge voluntary effort had to be maintained.
- The improvement in teacher's ICT skills since the project commenced which in the opinion of one coordinator had led to a 500% increase in their ICT skills.
- Parent training courses in IT and WFL were already underway for the primary school parents and the secondary school was planning to commence parent training on WFL during the next term.
- Concern around the long term sustainability of the project when the support structures and internet cover charges provided by IBM and the NCTE were removed.
- Frustration in relation to technical 'glitches' in the WFL system, software bugs and the changeover to the newer version of the software, all of which had caused operational difficulties for staff as they tried to use the system. As one person commented, *"so far we've been lucky that we haven't had active opposition. It's hard to capitalise on the enthusiasm of people when the system doesn't work as it should"*.
- Criticism of the 'Change Management Course' which IBM had organized. In their view it had too much of a corporate focus with little relevance for or applicability to schools. This, combined with other interactions they had with IBM, caused them to question the extent to which IBM really understood how schools operated.

Nonetheless, as one of the IT coordinators pointed out, they didn't want me to go away with a negative impression of the project. While there were issues of concern which they felt should be raised, she was keen to stress that to date the project had been very successful and that in terms of ICT development they were now miles ahead of where they were six months ago. There was general agreement among the group on this point.

By the end of the meeting both schools agreed that they would facilitate my PhD research work in whatever way they could. They suggested that I would be welcome to attend a forthcoming face to face meeting between all five WFL schools which they would be hosting in two weeks time. At the end of the meeting the school principal from the secondary schools invited me to join her for lunch and it was agreed that after lunch the coordinators from both schools would meet with me individually to outline how the project had progressed to date and to give me a tour of their computer facilities.

The Nature of School Site Visits

Because of the geographic distance between the site two schools and the researcher's base which involved a four hour train journey, not to mention the expense involved which was funded through my own means, I had to adopt a different approach to the research visits to the site two schools. Obviously weekly visits to conduct observation studies were out of the question. I opted for monthly visits instead and kept in regular contact with the IT coordinators in both schools by email and phone.

The main focus of my research visits and email contact was to keep abreast of WFL project progress, although I did have some opportunity to conduct a small number of computer lab observation sessions in school four. Because the site two schools were conducting parent specific training on WFL, I arranged some of my site visits to coincide with these training sessions which I attended as an observer. These training sessions were delivered at night so they involved an overnight stay. This meant that the visits which I made to the schools during March and April 2000 when the parent training courses were running were quite intensive. They usually involved travelling by morning to the site, conducting an update visit in one of the schools in the

afternoon, attending the parent session that night, conducting an update visit in the second school the next morning and then traveling back home by train in mid afternoon. The nature of this type of interaction meant that I had a lot of opportunity during these visits for informal contact with the IT coordinators and the principals in both schools, as they always made a big effort to ensure that I was taken care of, particularly at lunchtime, teatime or at night when the parent training courses were finished. These informal contacts were extremely useful in providing me with additional insights into the cultural context of the schools and their progress with the WFL project. The effort which they made to accommodate me as a researcher and to make me feel welcome at all times is undoubtedly reflective of the caring and friendly culture that exists in both schools. This in turn is influenced by the religious ethos that permeates the schools.

In all I conducted eight visits to the site two schools during the period November 1999 to June 2000. These were conducted on the following dates:

- 27/11/99: Initial meeting during which I was given a tour of the computer facilities in both sites. Duration 1 day.
- 12/12/99: Joint meeting for all five WFL schools which was hosted by and held on site two. Duration 1 day.
- 2/3/00: WFL project progress update meeting conducted separately with both schools. Duration 1 day.
- 13/3/00: Attendance at WFL parent training course for school 4. Duration 3 hours.
- 20/3/00: Attendance at WFL parent training course for school 4. WFL project progress update meeting conducted separately with both schools. Lab observations at school four. Duration 2 days
- 6/4/00: Attendance at WFL parent training course for school 3. WFL project progress update meeting conducted separately with both schools. Lab observations at school four. Duration 2 days
- 1/7/00: Conduct in-depth interviews with staff at school 3. Duration 1 day
- 8/7/00: Conduct in-depth interviews with staff at school 4: Duration 2 days

I did not conduct a site visit during the month of May due to the fact that I attended a day long joint site meeting of the WFL schools hosted at a neutral venue on 11/5/00. The presentations delivered by the site two schools as part of this meeting yielded sufficient update on their project progress at this stage to warrant a site visit unnecessary.

Having outlined the key contextual information for the WFL project at site two and the research background, I will now deal separately with the main case data for each school in the remainder of this chapter.

School Three Profile

While initially founded as a single sex girls school, school three is now a mixed gender school as a result of a merger with a local boys school which took place in the early 1980's. This entailed a huge change for the school and according to the existing school principal the transition period was a difficult and painful experience for all involved. The school is located in a modern building built during the 1970's in the aftermath of the introduction of free secondary education. The new building was constructed onto the older secondary school building which had been in existence for over 50 years. This older section forms part of the existing school structure and is known as the 'old building'. The school has 561 pupils and of a total teaching staff of 46, 18 are male and 28 are female. The principal and vice principal are also female. Both are engaged in full time administrative and managerial duties. The school has a distinct catholic ethos which means that the school is concerned with the moral and religious development of students as well as their intellectual development.

A lively, friendly and caring atmosphere permeates the school and there is a close relationship between teachers, students and parents. Many parents themselves are past pupils of the school and most of the teachers live locally. Overall it is quite a tight knit community. The school has a very active parents council which supports the school in a variety of ways through fundraising and other events. The principal has been very proactive in encouraging parents to join the parents council so that

they can have a meaningful say in how the school is managed and run. Parents have responded in kind by demonstrating a willingness to become involved.

When the WFL project was offered to the school, parents were encouraged to attend the initial demonstration of the WFL project in the school hall which was delivered by IBM and the NCTE and through the parents council they had a say in whether the school should take on the project. The parents council was enthusiastic about the project and have since played an active role in supporting it. It was they who organized the initial training in IT for parents which was delivered by the school IT co-ordinators and surveyed parents to determine the levels of computer skills before the courses commenced.

Since the arrival of WFL the school has made every effort to promote it among parents. Every letter which the school sends out to parents is accompanied by a reminder about the project and the project's website address. The school has included an information page on WFL in its enrolment booklet for prospective students and they have run regular demonstrations and open days for the community on the project. To facilitate parents who don't have computer access at home, the school has created a parents room where PC's have been installed so that parents can come in and use the WFL system. Such is the strength of parental support for WFL that after only two years of implementation, the principal was able to sideline one computer teacher who didn't use WFL into other teaching areas because of representations that she received from parents who felt that their children should be more involved with 'Wired for Learning'.

Without question the principal in school three was the main driver behind all that was going on in the school. She was a calm, effective and extremely efficient administrator. She was also an excellent leader who was well respected by staff and pupils with whom she enjoyed a good relationship. She was fair-minded and quite capable of making tough decisions when needed. She knew how to delegate and when to intervene. In terms of leadership style she fitted the 'Initiator' profile as described by Hall & Hord (1987):

"Initiators hold clear, decisive long range goals for their schools that transcend, but include implementation of current innovations. They have a well defined vision of what their school should be like and of what teachers, parents, students, and the principal should be doing to help the school move in that direction...They listen to their teachers, then make decisions...Initiators push; they have strong expectations for students, teachers, and themselves, and they push to see that all are moving in goal-oriented directions...Initiators tend to be adamant but not unkind" (p. 230).

The smooth and relatively easy integration of WFL into school three can be attributed to the leadership role which the principal played in its implementation as the following sections will illustrate.

School Three – History of Computing

School three first became involved with computers in the early 1990's when one of their teachers with an interest in IT founded a computer club in the school for students. The computer club operated after school hours and was popular mainly among male students. It had a heavy programming and technical bias. The computers used were mainly second hand Apple computers donated by local industry. As a result of the popularity of the computer club the school decided to develop further its expertise in this area and with the help of parent fundraising and investment from the board of management the school purchased six Powermac machines during the mid 1990's. These machines were used mainly to support technical, engineering and science subject which meant that there was a distinct male bias in terms of computer utilization and that the use of computers in the mainstream curriculum was limited.

Aware of the need to increase their level of ICT access for students, the school embarked on a further round of fundraising in 1997 and again with help from the board of management plus an investment from the NCTE raised sufficient funds to purchase a mini PC network of 9 PC's and one Dell server. Two rooms were knocked into one to form a computer lab. Once this lab was installed staff interest in ICT widened and began to grow and on the strength of this the school applied for funding for a SIP project, from which their participation in Wired for Learning evolved. In addition to applying for a SIP project in its own right the school was also

one of thirteen schools nationwide participating in another SIP project known as the 'Datalogging in Teaching Science' project. The aim of this project was to investigate the most suitable types of datalogging hardware for use in computer based Physics and Chemistry laboratory experiments in second level schools.

School Three – WFL Infrastructure

Description	Details	Quantity
Server	Netfinity 5500 Server Intel PentiumII 400 Mhz processor 512 MB RAM 90 GB hard disk Raid Support Internal 20/40 4mm tape drive 15 inch monitor UPS Rack mounting 10/100 PCI Ethernet Adapter(x2)	1
Aptiva Multimedia PC	350 MHz Processor 64MB RAM 8GB Hard Drive 32x CDROM Speakers 15 inch Monitor Keyboard, Mouse 100/10 Ethernet Card	34
IBM laptop	Thinkpad 390 Pentium2 350 64mb ram- one with modem -One with network card	2
Desktop Projector		1
Cabling	Category 5 Fast Ethernet cabling installed by PFH	53 Drops
	Older computer room network Fast Ethernet (installed by Dell)	13 drops
Internal network	3Com hub and switch in server room serves new section of school. A pair of hubs in computer room serve old part of school and send to primary school	
Internet Connectivity	128 Kbps Frame relay line to Internet Service Provider for two years Through cisco 2600 router Internet Service Provision for two years	
Connection to Primary school	Category 5 fast ethernet Cable linking between hubs and crossing adjacent buildings	2

Figure 25

Participation in Wired for Learning resulted in a substantial increase in the amount of hardware in the schools as another server, 34 multimedia PC's and a networked laser printer was installed. This enabled the school to install a second computer lab. With the installation of the WFL infrastructure the PowerMacs were deployed to the school library for student research purposes. A number of machines were allocated to the parents room, special needs room and main office. Single PC's were also allocated to specialist teaching rooms such as the science lab, the technical drawing lab and the biology lab. A PC was also installed in the principals office, the careers office and the year heads room. Most interestingly of all, six multimedia PC's were installed in an annex adjoining the staff room to encourage and facilitate staff usage

of ICT. This turned out to be a very wise and smart decision. However similar to the arrangement in the second level school in site one, no computers were installed in mainstream classrooms.

As a result of its involvement with ICT since the early 1990's and participation in the WFL project school three now has a very well resourced and up to date technical infrastructure with a network of computers strategically deployed throughout the schools as this diagram indicates.

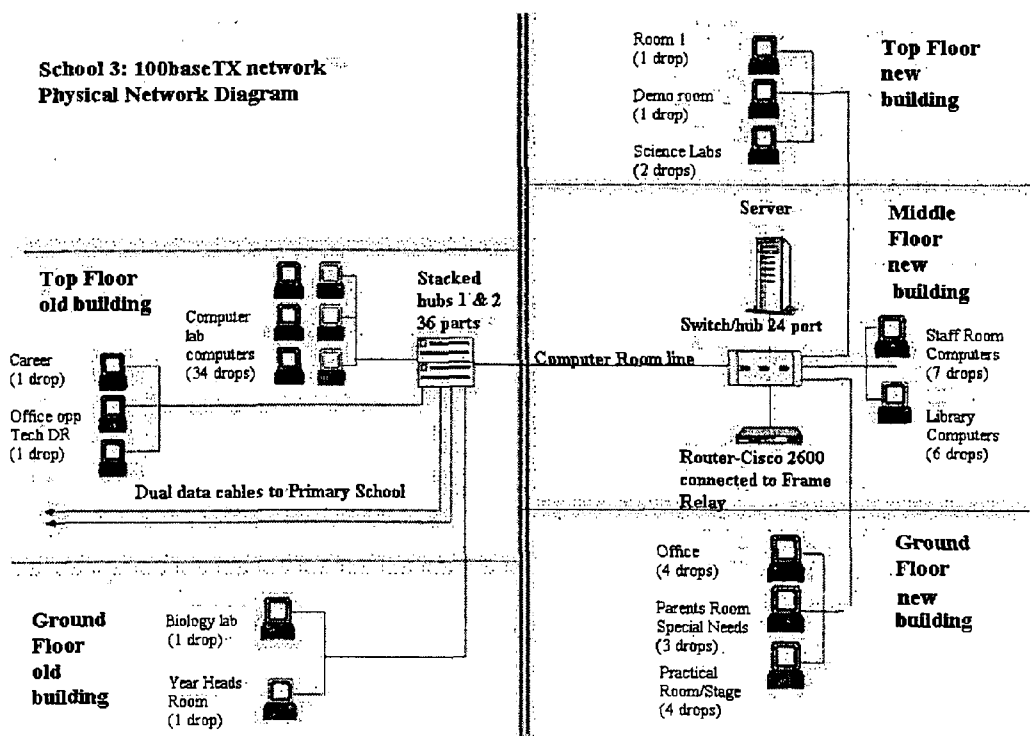


Figure 26: School 3 Physical Network Diagram

The IT Coordinators

One of the most distinctive features about school three was that they had two IT coordinators, one female teacher who was officially appointed as the WFL project coordinator and one male coordinator who was the technical IT coordinator for the project. Although ostensibly they performed different roles they effectively operated

on a 'two in the box' basis which brought a sense of cohesion and a 'gravitas' to the project's implementation.

The choice of these two candidates as IT coordinators was interesting as they both belonged more to the humanities side of the staffing equation rather than the scientific side which was where much of the impetus behind this school's initial ventures into ICT originated. This can be attributed to a strategic decision made by the principal, who had become quite concerned about the distinct male and scientific bias which she had noticed emerging in relation to computers and computer access. The computer club membership in particular 'annoyed' her as she felt that the teacher who started it, although technically very good and innovative, only appeared to encourage boys to join. She was disturbed that the development of 50% of the student population in this hugely important area was being neglected. So when the WFL project came along she was keen to redress this balance by appointing a female teacher as the WFL project coordinator, so that female students would have a high profile role model. The teacher in question taught mainly business studies and had experience of computers as she already taught computer applications to Transition Year students and was doing a night time masters in IT in education through one of the local universities. So she had good credentials for the post.

The second IT coordinator's specialism was art and he was quite interested in IT to support his own subject area and his part time work as a professional musician. In the wake of the development of multimedia technology he had by his own admission become a bit of a 'self-taught techie' as like many artists and musicians he began to experiment with computers to expand his creative endeavours in art and music. He was a late recruit to the teaching profession, having spent a number of years working in music and the arts before becoming a full time teacher. Like the other coordinator he too was studying for a part time masters in IT in education.

Together these two candidates brought a range of complementary skills to the project. They were both experienced members of staff, in the thirties to forties age group. While the female coordinator concentrated her efforts on managing project milestones, staff development and how best to deploy the WFL system to support teaching and learning, the second coordinator took charge of network installation

issues, day to day maintenance and staff training. Because of the close proximity of schools three and four the WFL infrastructure was constructed as a local area network (LAN). Consequently school four accessed the server in the school three for its WFL and internet needs which meant that the IT coordinator in school four was effectively the system administrator for both schools. Splitting the responsibilities for the project between the two coordinators ensured that no one person was carrying an overly burdensome workload. Nonetheless managing and running the project involved a significant increase in workload for both coordinators, particularly for the technical coordinator whose role expanded considerably as the project progressed.

Probably one of the biggest advantages in appointing these two candidates as coordinators for the project rather than the more innovative staff members who originally introduced ICT into the school, is that they both fitted what Rogers (1983) categorized as the 'early adopters' profile. Although quite innovative in their own right, early adopters are characterized as being more cautious than innovators and therefore are more 'homophilious' i.e. have more similarities with other members of a social system. Typically early adopters are 'not the first by whom the new are tried, nor the last to lay the old aside' (Pope, 1711). Because early adopters are not too far ahead of the average individual in terms of their innovativeness, their opinions on whether an innovation should be adopted are usually highly influential. Consequently early adopters function as good role models and their opinions and actions are highly respected by other organizational members. According to Rogers (1983) early adopters have the greatest degree of opinion leadership in most social systems. Therefore a wise leader, particularly when operating in a system with very traditional norms and values, where innovators are often perceived with suspicion, will try to initiate change by utilizing the opinion leaders with most influence in the system as chief change agents rather than innovators themselves. When correctly implemented and managed this strategy can assist the speed at which an innovation gets adopted in an organization by helping to reduce the uncertainty and tension about an innovation among an organization's members.

The role which the two IT coordinators played as project leaders and change agents was enhanced by the level of support provided to them by the school principal and vice principal, both of whom were enthusiastic proponents of the project and who led

by example by engaging with the project at a variety of levels, both strategic and practical. This formidable foursome who operated in unison and with a distinct sense of purpose was instrumental in galvanizing staff support for the project and paving the way for the project's smooth implementation. The principal in particular played a crucially important role.

Wired for Learning Implementation and Focus Areas

Of all the WFL schools, school three was the most focused in terms of how it wanted to utilize the WFL system and the most strategic in how it planned for the project's implementation. As previously mentioned it was the only WFL school that had applied directly for a SIP project and their original SIP proposal related to the use of the internet for the professional development of its staff. This in itself indicates that the school is as concerned about the growth and development of its teachers as it is for its pupils, a fact which suggests that the school has a learning organization orientation. When the WFL project was offered to them they immediately grasped the project's potential as a staff development vehicle and the technical infrastructure was clearly an added incentive, but importantly, not the primary one.

When it came to galvanizing staff support a number of different steps were taken. Initially the project team, led by the school principal consulted widely with all members of staff about the proposed change from the original SIP application to the WFL SIP project. They only agreed to take on the WFL project when they secured majority staff support. As the principal explained:

"I suppose I'm the type of person who investigates anything that comes in the post and I apply for everything. So when the application form came in for a SIP project I spoke with our IT coordinator about it and she came in during half term and we filled out the application form. Then we had contact from IBM and they came down and met us and I was extremely enthusiastic when I learned that we were being considered for such a good project. We did our best to get the interest up from all parties because I could see the possibilities for the development of the school and for staff development and for communication with parents. We have a strong relationship with parents anyway and this was a way of furthering that and making use of it as well."

Once staff support was secured they then identified a nucleus of other staff members with IT skills whose expertise could be leveraged to help train and support other staff members and to support the IT coordinators. These staff members attended the initial WFL training with the IT coordinators and they then worked alongside the IT coordinators in delivering WFL training to the remainder of the staff. To encourage staff usage of WFL, the staff work area which was located in an annex off the main staff room was transformed into a staff computer room. Six networked PC's and a high speed laser printer were installed into the annex. This was a very smart move as it gave staff the opportunity to become familiar with technology in a supportive, non-threatening atmosphere and at their own pace. It also sent out a subtle signal to staff that the school wanted them to begin using technology as part of their normal daily work routine. Whenever I went to the staff room for a tea break while visiting the school, I used to pop into the annex to check my own email and I noticed that staff regularly came in and out to check out internet sites for their classes, to send off emails or to print out material from the web. Given that PC's were not installed in mainstream classrooms, this was an excellent way of facilitating regular and easy computer access for staff and of 'normalising' the use of technology as the following comments illustrate:

"In terms of integrating technology well first of all it meant that we got hardware into the inner staff room. We have high speed access there and on a very general level, it has improved the general awareness of technology among the staff. The situation in the inner staff room where the 6 computers are is ideal. A lot of teachers bought computers for home after they got familiar with the system and they were clunkier and slower and they couldn't understand it. So it's a state of the art system. As regards day to day teaching it hasn't made that much difference yet. I think we've got through the first phase, we're familiar with it, we know what it can do, but we're waiting for it to really kick in this coming September".

Teacher 4, School 3

"Having the 6 computers in the inner staff room is just absolutely brilliant in terms of accessing resources. You can be in there and someone might say there's a great French site, Spanish site or whatever – check that out. You can get really good stuff..... There's a great buzz there, not least because people are chatting to each other in the inner staff room using the computers and pointing out great websites. We've had some laughs with the internet- people getting funny emails and all that... (Teacher 3, School 3)

"I think the belief that they can actually do something on computers has helped staff morale. Even yesterday we had a powercut and a teacher who has never put in results into 'Facility' before [Facility is a computerized system which allows teachers to electronically communicate end of year exam results to the Department of Education and Science] came in to put them in, but the power had been switched off and we needed passwords and all that [to get the system up], and she still wasn't put off by that. She wanted to be able to put in the results herself rather than handing them to the school secretary like she has always done in the past."

Principal, School 3

In terms of WFL's implementation school three adopted a prudent, pilot strategy. Rather than overwhelming staff with all that needed to be done they prioritized what they wanted to do and concentrated on those areas first. In that way the project was implemented in 'manageable chunks'. In the start-up phase which covered the period March – May 1999 the project's aims and objectives for the school were defined. It's aims were:

- To integrate ICT into all areas of the school environment
- To enhance learning and communications between the educational partners – Teachers, Students and Parents

It's objectives were:

- To use the areas of Science, Languages and Transition Year as a pilot scheme for evaluation of WFL
- To enhance communication between teacher/teacher and teacher/parent
- To make online resources more readily available
- To upskill teachers, parents and pupils in ICT
- To provide examples of best practice for dissemination on a wider scale.

During the first year of the project's implementation, staff IT training and WFL training were defined as the main area of focus for term one (September – December 1999) and the project team concentrated its efforts on this area. In addition staff were

encouraged and assisted by the WFL training team to create their own home pages on the WFL system. As this was an easy and fun tool to use, it was a good way of familiarizing staff with WFL without them feeling intimidated and overwhelmed by the system. At this stage there was no pressure put on staff to use the WFL system with students or in class.

For terms two and three which covered the period January to May 2000, attention was directed at the use of WFL's instructional planner and communications tools. To assist this process a school technology committee was formed in January 2000. This committee included four teacher representatives from the languages, science, transition year and career guidance departments along with the two IT coordinators, principal and vice principal. One of the first tasks of this committee was to draw up an acceptable use policy for internet use in the school. The four teacher representatives were also charged with responsibility for piloting the use of WFL to support their subject areas. In the case of the languages, science and transition year areas these lead teachers were involved in piloting the use of the instructional planner among the staff teaching those subjects. To this end teachers were released to work in groups during which time they prepared sample online unit and lesson plans. The Career Guidance teacher was responsible for investigating the feasibility of establishing links with external personnel who would serve as mentors for senior cycle students in the area of career guidance. She was also investigating how WFL could be used as a communication tool between teacher, employer and student in the area of work experience during the Transition Year work experience module. The IT coordinators and the principal constantly reminded staff how useful WFL would be as a school planning tool once the up and coming Whole School Evaluation initiative which DES was planning to implement in schools was introduced.

In terms of WFL's communication tools, attention was focused on the Teacher's Lounge and the Calendar of Events. A pilot WFL training course was also scheduled for delivery to parents at the end of March 2000 to encourage the use of WFL's private conferencing facilities. In promoting the use of WFL's internal communication tools the principal led the way by her usage of both Teachers Lounge and the Calendar. She was very proactive in this area and she posted all daily notices onto Teachers Lounge and used the calendar to keep teachers and parents informed

of key school events, meetings and other important dates. Whenever I dropped into her office while visiting the school, her computer was always switched on and invariably she was using WFL. She herself found the tool particularly beneficial in supporting her work.

"From a communication point of view I would think it certainly has helped to improve the efficiency and effectiveness of school management. It's great having things at the press of a button rather than on pieces of paper. Then when it comes to communication, even though the vice principal is only two doors down, if she's not there, I can input data into WFL and it's there when she gets back, rather than I making notes and slipping them under the door. It's easier to put them into WFL and there is a record of it there as well".

Through her use of the system the principal was leading by example and sending very clear messages out to staff that she wanted them to routinely use WFL as part of their work:

"I think it's use is going to expand in our school more and more....From a teacher's point of view it's very good for letting the principal know about things and for making announcements. I do a lot of sports in the school -so for things like matches and so in it's just very easy to use....The principal uses it an awful lot herself anyway. Any kind of announcement that has to be made she puts it on WFL and she would always say to you on a one to one basis - 'I got your message today'. She is very supportive of it, definitely".

Teacher 3, School 3

Parental Involvement

Training parents in the use of WFL was the responsibility of the IT coordinators. As a precursor to WFL specific training they ran separate basic IT literacy course for two groups of twenty parents in October 1999 and February 2000. During March/April 2000 they followed this up with a pilot WFL training course which was attended by ten parents in all. This was a three week night course and I attended one of the training sessions as an observer. All the course attendees were women. Most of the parents were quite PC literate and did not appear to be experiencing any difficulties with using WFL's conferencing tools during training.

Both coordinators delivered the course and because it was delivered at night time this involved extra commitment on their part outside of normal working hours. This did not appear to be an issue for them. As an observer I felt it was a good idea that it was teachers from the school who were delivering the training to teachers rather than an independent computer trainer from outside the school, as was the case in the site one schools. This could only help to promote closer ties between parents and teachers. Delivering the course at night time rather during daytime hours was also indicative of an attitude and a willingness to provide training at a time that was more convenient for parents rather than the teachers or the school.

I should point out that the coordinators were keen to stress to that this course was very much a 'pilot' course which aimed to evaluate the private conferencing potential of WFL and how best to encourage parents to use the system. They did not envisage live conferencing between parents and teachers taking place until the following academic year. This was in keeping with the very deliberate 'softly-softly' approach that the school had adopted in all its interactions with WFL during this first implementation year. To cater for those parents who did not have PC or internet access at home, the school created a parents room in which a number of PC's were installed for parents to use.

Conclusion

Of all the WFL schools, the staff in school three demonstrated the most enthusiasm for the WFL project and it was the school where the least amount of resistance to the project surfaced. A combination of factors contributed to this. First of all by virtue of its SIP application the school was already primed, in other words 'ready' for a project like WFL. Secondly the school had already identified the professional development of its teachers as a priority and it viewed WFL as a tool which could assist this. In other word the innovation was 'relevant' to its needs. Furthermore the 'relevance' factor was further enhanced by the efforts of the project team who constantly emphasised WFL's relevance to the forthcoming whole school evaluation initiative. Due to the strategic and gradual approach it adopted to WFL's implementation, people had space and time to experiment with the technology.

Furthermore by involving different staff members at different stages in leading different areas of the project's implementation, the conditions were created in which an influential opinion leadership network could emerge. Finally as an 'initiator' style manager, the school principal played a vital role in making it all happen.

School Four Profile

The primary school is predominantly a single sex girls schools although it caters for boys in the three junior cycle classes who then move onto a senior primary all boys school. The school building is old as it was built during the first world war and was officially opened in 1916. The school has 420 pupils and a total teaching staff of 18 plus the principal. All staff are female and the vast majority are former pupils of the school. Most of the teachers are in their mid to late forties. The same catholic ethos and close relationship between teachers, parents, school and the local community that exists in school four also exists in school three. The parents committee plays an active role in supporting the school and they too have been encouraged to become involved with WFL. A parent's room with WFL access has been installed in the school.

There is a lively, energetic and homely atmosphere in the school and there is a close, almost family like bond between the teachers and pupils. The teachers know the mothers of many of the children extremely well as they themselves taught many of the mothers when they were pupils here. Teachers see the development of the child as their prime raison d'être and they will willingly take on any new initiative which they think will enhance the educational experience of the child. The predominant teaching style in the school is oriented more towards group and collaborative learning than rather than teacher directed learning. There is a good atmosphere in the staff room and teachers seem to collaborate a lot with each other on school and curriculum related matters. Whenever I joined them in the staff room during break times, they were friendly, chatty and interested in talking to me about my research and how I was getting on. Many teachers extended open invitations to me to observe their classes whenever I wished. The principal, who enjoys a good relationship with her staff regularly joins them for coffee and lunch in the staff room. Her managerial

style is predominantly 'responder' oriented and she is a jolly character who does her best to accommodate and please everyone.

History of Computing

School four had been involved with ICT since the early 1990's where the schools interest in this area had been driven primarily by the commitment and vision of the IT coordinator. As a result of her drive and energy the school had become involved with computers long before the 'Schools IT 2000' initiative and had established a reputation locally as an 'IT school'. Consequently before the WFL project arrived the school already had a good IT set up. It had its own dedicated computer room in which there were 16 Acorn computers, 4 PC's, one with internet access, an Apple Mac, 4 Printers and a scanner. The remedial room also had a computer and printer and there was also one Mac and one printer in the main school office. Extensive fundraising by the school and the parents committee had funded the equipment over the years. Interestingly the current IT coordinator was officially appointed IT coordinator in a post of responsibility capacity as far back as 1992. This in itself indicates that the school is quite progressive in its outlook and that it has an innovative orientation.

To ensure maximum use of the computer lab, the IT coordinator who was self taught in computers voluntarily ran several IT training courses for other members of staff and provided support for them on a one to one basis teachers during the early 1990's. Wisely she refused to become the 'IT teacher' as she wanted each teacher to take responsibility for teaching her own class in the lab. Consequently each class was timetabled for an hour long weekly slot in the computer room where class teachers were expected to conduct her own lab sessions. Under her expert guidance and with input from other members of staff the school had built up an excellent store of software packages in areas as diverse as logo, drill and practice, art, typing tutors, word processing, DTP, language development and problem solving for all age groups across all subject areas. To ensure a consistency of approach across all year groups and to eliminate overlaps the school had a very well defined ICT scheme of work which had been devised by the ICT coordinator with buy-in from all staff members. By 1998 the school had produced a comprehensive ICT plan. This plan was devised

and approved by the school committee comprising class group representatives, parents and school management and the school ICT advisory committee made up of individuals from the local community with relevant expertise in ICT.

From an analysis of the school plan and my own interactions with the school, I would say that school four was the most ICT advanced of all the WFL schools in terms of its integration of ICT as a cross-curricular tool and in terms of regular use of the computer lab by all members of staff. Long before WFL arrived on its doorstep it had a very clear vision of how it wanted to use ICT to support the curriculum and the development of its students. The IT coordinator also ran an after school computer club for exceptional children and she trained many of the school's senior students to act as 'technical support assistants' for the school. These students were in charge of loading and unloading software onto the machines for different teachers before and after lab sessions. They could also be called upon to troubleshoot minor technical problems if a teacher encountered them during class. This simplified the task of organizing and running lab sessions for the teachers. In terms of children's access to the lab, the school had an open and easy policy. The lab was left unlocked at all times and children were free to use it independently during lunch breaks and after school hours.

As already outlined, a lot of persuasion was required before school four finally agreed to take on the WFL project as they were already involved in another innovative pilot project related to foreign language development. Staff were concerned about being overstretched with two pilot projects on the go and how they would get the time and energy to do justice to both projects. However following assurances from IBM and the NCTE in relation to training and ongoing support, the staff agreed to participate in WFL as it was evident that there would be considerable advantages to participation in the programme in terms of student, staff and community development and also IT infrastructure.

When the Wired for Learning equipment arrived, 4 PC's were installed in the existing computer lab. This meant that the lab now had 8 state of the art networked multimedia PC's with high speed internet access and 16 stand alone Acorn computers. 16 PC's and 16 printers were deployed into the classrooms so that each

class had its own individual PC and printer. One PC was installed in the Parents Room and one PC was dispatched to the staffroom. A PC was also installed in the administration office and the principals office. Because of its proximity to school three, no server was installed in school four. Instead it accessed Wired for Learning from the sever in school four via a fast Ethernet cable link. According to the IT coordinator the infrastructure investment which came with Wired for Learning, equated to 10 years of fundraising by the school committee which would have taken them a lifetime to acquire.

School Four – WFL Infrastructure

Description	Details	Quantity
Shared Server	Netfinity 5500 Server Intel PentiumII 400 Mhz processor 512 MB RAM 90 GB hard disk Raid Support Internal 20/40 4mm tape drive 15 inch monitor UPS Rack mounting 10/100 PCI Ethernet Adapter(x2)	1
Aptiva Multimedia PC	Micro Tower (2x4), PCI/ISA Processor Type: AMD K6-2 with 3D Now Technology 333 MHz (x) Memory – standard 64MB/maximum 256MB Disk Capacity: 8 GB	26
Cabling	Cat 5 Fast Ethernet installed by PFH Cork	30
Internal network	High speed network connecting 33 workstations to WFL server in Colaiste Muire	
Laptop	Intel Pentium processors with MMX technology at 300 MHz large TFT active matrix display. Highspeed CD-ROM drive, 4.3 GB hard disk drive. PC Card modem.	2
Internet Connectivity	Direct link to 128 Kpbs Frame relay line to Internet Service Provider for two years Through Cisco 2600 router in Secondary school	

Figure: 27

The IT Coordinator

The IT coordinator was an experienced member of staff with 25 years teaching experience behind her. She was an extremely energetic and enthusiastic teacher who was passionate about her work. She was by all accounts an extremely innovative and driven individual who put the needs of her pupils and the school before everything else, including her own personal needs. She clearly gave 110% to her work, was invariably the last to leave the school each day and continued on working from home

in the evening. Some teachers reported regularly receiving work related emails from her at two and three o'clock in the morning. Another teacher commented: *"It's amazing how far we have come in IT – and it's all down to her. She had a dream, it's her dream come true. She used to stay up till 3 o'clock in the morning – eating up computer manuals while others were off doing courses. She taught herself and she had a dream."*

While the IT coordinator was undoubtedly admired and respected by her colleagues, her standards were so high that I got the impression that most of the staff were somewhat in awe of her and deep down probably felt that they could never match her high standards. In many ways the IT coordinator typifies the classic 'innovator' profile as defined by Rogers (1983). According to his theory innovators play an important role in the diffusion of innovations by bringing in new ideas from outside the system's boundaries into organizations. As against this however he argues innovators can be poor opinion leaders and change agents in systems with traditional norms because "the most innovative member a system is very often perceived as a deviant from the social system" (p.27). Consequently the innovator serves as an unrealistic model for the average client because he or she is seen as being too elitist and too change oriented. Thus the innovator's role in diffusion, particularly when it comes to persuading others to adopt an innovation, is often limited. This theory suggests that innovators are less influential as change agents and opinion leaders in traditional organizations than in organizations which are oriented to change. The story of WFL's implementation in this school supports this theory, as we shall see later on.

Of all the IT coordinators I dealt with in the course of the research, the school four coordinator was the most proactive in her dealings with me and the most professional in terms of her technical project management capabilities. She regularly emailed me with project progress updates and kept me informed of project developments and she did everything she could to assist me whenever I visited the school. She was extremely thorough in how she documented and recorded everything in relation to ICT in the school and the project's progress. She had all the project milestones clearly worked out in advance and she kept a regular track on progress against projected timelines to ensure the project was proceeding as planned.

When it came to her mainstream teaching duties she was equally as thorough and professional. I had the privilege of spending part of a morning in her class observing her teach and also observing two separate computer lab sessions (7/4/00; 2/3/00) that she conducted. Not only was she extremely dynamic but it was clear that her pupils thought the world of her and she of them. She was the type of teacher which any parent would just love their child to have for their entire schooling days. Her class, a 5th class, although organized like clockwork precision, was fun, interactive and engaging. There was so much going on that the children didn't have time to be bored. Irrespective of what she was teaching, children went up in pairs every 15-20 minutes to work on the computer. On the day I was there the children were learning how to do e-mail attachments and one of the students who according to the teacher " was very good on the computer" was teaching and guiding the student pairs through the emailing exercise.

As the children were due to commence working with logo as part of their scheduled lab time later on that day, the teacher devoted some class time to preparing them for this task. Her approach to teaching logo was practical and involving. She used a variety of teaching methods to get across the concept of 45, 90 and 180 degree turns. First she drew them on the board and she then questioned the children to see how much they had taken in. Next she got two children to stand up in front of the class and to turn at 45, 90 degree angles etc. in accordance with her instructions. She then get the whole class to stand up and follow her instructions as she called out the directions that she wanted them to turn (right/left) and the angle of the degree, much to the delight of the children who enjoyed the exercise.

Later that afternoon when the class went down to the lab, the session commenced with all the children gathering around the flip chart in the lab where the teacher took them through the different logo command that they would need to use in the course of the exercise. She used this technique of calling the children together as a group at various stages during the lab session whenever she needed to take the children away from their computer work in order to clarify points and introduce new concepts. This gathering around the teacher at the flipchart was an informal affair as some children sat on the floor, others stood and others sat on top of the work benches. This

casualness created a relaxed atmosphere in the computer lab that contrasted sharply with the site one school lab sessions where children were expected to remain seated at their terminals at all times.

In another one of her lab sessions that I had observed previously (2/3/00) I noted the buzz and sense of activity that pervaded the room. That day the children were working on a variety of different activities. Some children were doing emails, some were using the internet and others were using the 'World Book Encyclopaedia' CD-ROM for a project they were doing on the Egyptians. The children were working collaboratively in groups of threes and there was a leader for each group. When the children ran into difficulties or had a problem, they were expected to turn to their group leader to sort out the issue. They were only permitted to consult the teacher for assistance if the group leader could not solve the problem. The advantages of this arrangement were twofold. Firstly it encouraged collaborative and peer learning. Secondly it made the teacher's task of managing and organizing the lab session easier and she could concentrate her energies more on facilitating the learning process rather than directing it. It is heartening to note that the relaxed and varied approach to student lab work was not confined solely to this class and this teacher as many of the positive and encouraging attributes which I observed here were also present in the lab classes run by other teachers in the school as the following section illustrates.

The Nature of Computer Use

I spent one full day (21/3/00) in the lab at school four observing computer classes in action. On this occasion I observed two senior classes comprising one mixed 5th and 6th class and one 5th class (i.e. a separate 5th class from the IT coordinator's) and two separate junior infant classes in the lab. The following month (7/4/00) I also had the opportunity to observe a senior infants class.

As the school building was quite old, the computer lab, like most of the classrooms had a worn look and feel to it. The room was quite large with a very high ceiling and it was quite spacious. It didn't have the professional look and feel of most of the other school labs that I visited as it had all the hallmarks of a lab that grew in an ad-

hoc way as the schools interest with ICT evolved. The room had no whiteboard or blackboard, only a flipchart. It also had no teacher's desk. This meant that there was no central point in the room. The computers rested on long old wooden tables located against the three main walls in the room. In the middle of the room another long table, protruding from the fourth wall into the middle of the room, also contained computers. Children sat along long continuous benches when using the terminals. From an ergonomics point of view the room was a bit of a disaster as obviously children couldn't adjust their seats. Furthermore the tables were made long before the advent of computers and were far too high even for adults let alone children. I noted in one of my observations how the heads of the junior students were level with the height of the desks which meant that the computer terminals were towering above them. Because the lab contained a mixture of Acorn computers and multimedia PC's, some of the computers looked quite old fashioned and quaint and two machines were even dual floppies.

Although they could have equipped the lab entirely with brand new multimedia PC's when the WFL project came along, they chose instead to only put a few PC's in there and distribute the remainder PC's to individual classrooms. Some of the teachers including the IT coordinator were keen to hold onto the acorn machines because they believed that the educational software produced for them was very good. However many teachers found that managing the two different platforms in the lab was difficult especially because students were constantly clamouring to use the more up to date flashier, faster PC's, of which there were only 8 in all in the lab. In addition some teachers complained about technical problems with the Acorn machines particularly when it came to printing from them. As against this however I found from my observations that the existence of two different platforms encouraged the teachers to be more flexible and creative in their approach to organizing and managing lab activities.

Despite the casual, ad-hoc and 'unprofessional' arrangement of the lab, it was in my opinion the lab where the most creative, stimulating, varied and collaborative teaching and learning activities took place when all four schools in which I conducted lab observations are compared. Both the ethos of the school and the influence of the IT coordinator played their part in this. As mentioned earlier, most

teachers described their existing teaching style as being more oriented towards group/mixed work or collaborative work rather than teacher directed. It is well known that there is a natural affinity between group work, collaborative learning and computer learning. Teachers used to working in this mode can accommodate computers more easily in their teaching as it as an extension of, rather than a radical departure from, what they are already doing. By her own admission, the IT coordinator wasn't the most technical brilliant person around, but she made up for this lack of technical prowess by her passion for the use of ICT in education. In how she went about organizing ICT to support her own teaching, encouraging the school to take a lead in this area and supporting other teachers to develop their own use of educational ICT, she was undoubtedly an inspiration to all around her.

In the two senior classes that I observed I was impressed with how both teachers organized and managed the sessions and the variety of activities going on there. As in the IT coordinators lab class, students worked in groups and on different tasks. In the mixed 5th and 6th class for example, some of the students were searching the web for information on the poet, W.B. Yeats. This exercise was related to a previous mainstream class activity which they had completed earlier that day when they had been studying the poem 'A Child Dancing'. Other children were doing posters on the PC for the forthcoming cake sale for the school. Some were typing up their 'news for the day' while some of the slow learners were practicing composition in MSWord. As one of the teachers was out ill, there were also two senior infant children in the class and the teacher had them working with the 'Animated Alphabet' package on the Acorn machines. This contrasts sharply with a similar situation which I encountered in both the site one schools where students from an absent teacher's class sat in the middle of the lab floor, doing nothing and looking completely bored while the teacher taught the main class. The teacher's own teaching philosophy which was reflective of the school ethos, would in my opinion, prohibit this type of situation occurring in school four. Commenting on her own teaching philosophy and style, the teacher had this to say:

"I try to make learning fun because I find if it's fun for myself, then it's fun for the children. I try to tackle everything from a fun or creative perspective. I would use a lot of drama in my teaching.....and I would do more group work and collaborative work, rather than teacher directed

work. I encourage pupils to be master of their own learning as I feel that they learn a lot from each other as well... We're a sort of a team and when it comes to computers the children in the school have helped me out. They know a teacher doesn't know everything and as soon as I learn something I impart that knowledge to them and vice versa. So it's a great collaborative thing in that we are working together".

Teacher 3, School four

In the 5th class lab session the teacher commenced the class by handing out corrected essays to students and encouraging them to correct their spelling mistakes on the computer as all of the essays were typed out. As a rule the teacher encourages them to type their work..... *"I really feel it they type it up and print it out, that it's easier for me to correct. It means you're not concentrating on handwriting and presentation but rather on the child's ideas instead"*. Again I noticed that the lab was organized so that there was a variety of activities going on. Four students were practicing typing using the 'Typing Tutor' CBT package. Another four students were doing Word Processing, correcting their essay spelling mistakes while two special needs children were working with the 'Aladdin' animated storybook CD-ROM. Fourteen students were working in pairs on the internet. Some were searching for information on the Lusitania for a project they were doing while others were searching for information based on a teacher prepared questionnaire. At different stages during the class, the teacher swapped the different activity groups around. I wrote in my observation notes at the time:

"There was a great buzz in the room. The children were really working well together, actively discussing with each other what they were doing and willingly sharing access to the screen and keyboard."

Obnotes (21/3/00)

In terms of her teaching philosophy and style, the teacher had this to say:

"I've never been asked about my teaching philosophy before. I think a big part of my philosophy would be that the children are relaxed and enjoying the class, having a good atmosphere in the classroom.....In the last couple of years I have been doing a lot of collaborative learning and group work as well as individual work... Computers would be one of my interest areas

and about 7 years ago I became involved in the writing process through computers which involved group work. One group working on a poem, another group working on composition, all different areas of writing. So computers would have been one of the main catalysts for my change from teacher directed to collaborative work”.

Teacher 1, School four

One incident in particular I think illustrates the level of enjoyment which the students derived from the lab sessions. As it approached morning break time, the teacher asked the students if they wanted to go out to the yard for their break or continue working on the computer. Unanimously and enthusiastically they replied that they wanted to continue working with the computers and forego their break.

In the junior classes that I observed, I noted that the teachers generally had the children working in pairs and again they used different software packages with different students and rotated them accordingly. Discipline was very relaxed and the students were allowed to freely move about, within reason. However due to the large class size, an average of 30 students per class, it became very difficult for the teachers to manage the class as the class moved on, especially when a child got stuck or a technical error occurred. Because the children were so young it really was extremely difficult for the teacher to keep their attention focused on the task in hand and one has to question just how productive these lab classes are with such young children in such large groups, without some form of teaching assistant available to the teacher. In one session I made the following observation notes:

“About 10 minutes into the session, I notice that out of a group of 12 children using word processing, five are not really doing anything at all in fact and are just messing around, sliding under the work bench etc. The teacher does not see this as she has her back to them while helping out some other children. At one point she directs one student over to help two girls who are having difficulty with the word processing software. He stays with the girls for about one minute before he too starts fooling around and abandons his task. As the class progresses the children's concentration seems to wane considerably. I notice two children who just seem to be aimlessly clicking on numbers in the software package they were using. I asked them what they were doing but they couldn't explain it. They just seem to be clicking at the nice pictures on the screen. The teacher comes

over to help them out. Meantime I notice another two children who are just staring blankly at the screen. The teacher goes over to help them out too. As she does this, three students are queuing up behind her looking for help. As I look around the group, I notice that another group of children who were using the word processor have all but abandoned their task and are just playing around...By the end of the class there are about seven to eight children simply running around the lab....As the session finishes, the teacher says to me that she feels the group in the lab is too much for one teacher to handle. She feels that 20 is the maximum number that should be allowed in the computer lab.

Obnotes (7/4/00)

When I later interviewed some of the teachers from the junior cycle they had this to say:

"The children enjoy the computers immensely but it's just to physically organise so many of them around the computer is the challenge. They have to take turns but they are not really into sharing because they are only four years of age and they want to dominate and take over. A few years ago when our lab didn't have so many computers as it has now, it was easier because you could let half play with colouring books and half way through you could switch them over. But they get tired very quickly. 20 minutes on the computer is enough for them really, but it's just the logistical movement of themYou need buckets of patience and earplugs when you're in there but they look forward to going to the lab every Tuesday and they are disappointed if they don't go, they really enjoy it, but for us it's hard work. It's harder than being in the classroom".

Teachers 7 & 8 (joint interview)

Both teachers felt that the lab sessions would be more productive and the children would benefit more if they could take half their class to the lab at a time or if they had a teaching assistant with them in the lab.

One thing which stood out very clearly from the interviews that I conducted with school four personnel was the extent to which all teachers and their students used the classroom PC as part of their routine class work. Furthermore their responses indicated that ICT was extremely well integrated to support the curriculum in all areas and that they used the computer lab time to enhance and extend the existing curriculum.

"We have an hour and a half timetabled in the lab each week. We do a mixture of things like poetry, word processing, sentence construction and we've made books and I've used it a lot for English for writing stories and poems. We have done graphs and integrated them into maths and I would have integrated it as well with other ideas from the classroom for researching material on school tours and for project work..... Sometimes if something spontaneous comes up and you want to use the lab, you can ring up another teacher and you might be able to switch around.....I use the classroom PC an awful lot. That goes on every day and the children use it all the time for websites, for information on nature and for doing the daily news....."

Teacher 5, School four

"IT is viewed as a tool or a skill. Our lab time would come out of whatever subject you are doing. The skill is taught as part of what they are doing be it research or word processing, the skill is taught along with the usage. So even though they are in the computer lab, they are not really doing computers, they are doing English, History, Maths or whatever subject they happen to be researching."

Teacher 4, School four

WFL Implementation and Focus Areas

School four was the most ambitious of all the WFL schools in terms of its approach to the implementation of WFL. It was also the school where the project created the most amount of stress and tension among staff. Given the level of ICT expertise in the school and the school's track record which suggested an innovative orientation, I was initially quite surprised and thrown by this as this was the school where one would reasonably have expected the project to have enjoyed a smooth implementation. In many ways school four was an excellent example of what Matthew, Huberman & Miles (1994) label the 'Extreme Case'. They argue that extreme cases can be very useful in verifying and confirming conclusions because the presence or absence of certain key factors increases confidence levels in the findings from cross case comparisons. In this respect the extreme case often functions as the exception that proves the rule.

On the face of it, school four appears to have done everything right. There was extensive consultation with staff before the project commenced and the school did not take the project on board until issues were sorted out to its satisfaction. Almost immediately an assistant IT coordinator was appointed to assist the IT coordinator in developing and managing the project and they were both designated as key tutors for the WFL programme. A WFL committee was formed to support the project in May 1999, 6 weeks after the school formally adopted the project. This committee comprised four parent representatives, the principal and vice principal, IT coordinator, assistant IT coordinator, the learning support teacher and a post holder with responsibility for curriculum development. The committees' first task was to undertake a survey of PC ownership and usage to determine the levels of interest and competence in IT among the school community. The results indicated that over 50% of pupils families were already using a PC while a further large percentage indicated a positive interest in acquiring computers. Around this time also, all staff undertook a six week IT upskilling course after school hours under the NCTE's Teaching Skills Initiative. In recognition of the existing level of ICT expertise among the staff, this was a condensed version of the Phase 1 and Phase 2 NCTE training. In addition two briefing sessions for staff specifically dealing with WFL were undertaken prior to them commencing the week long summer course in WFL in July 1999.

Meantime the project goals for the school were determined by the WFL committee with the stated aims of developing children's literacy skills, helping teachers to develop and share resources and establishing greater dialogue between teachers, parents and students. A detailed list of objectives to help achieve each of these three aims was drawn up and this is included in *Appendix Z3, Case Record, Volume 111*. The key focus areas for WFL were defined as:

- Communication
- Instructional Planner
- Pupil Involvement

Plans were put in place to implement use of WFL's tools for the new school year commencing September 1999 in each of these areas once training had been completed. Under the stewardship of the IT coordinator goals and targets were defined for teacher use of WFL's communication applications including Home Page Designer, Teacher's Lounge, Events@School and Private Conferencing. To get Private Conferencing up and running the IT coordinator commenced delivering night courses in basic IT skills and WFL specific training for parents once the new school year began. By the end of the second term over 30% of parents had been trained in WFL. Following on from this a parents team was trained to construct and maintain a Parents Home Page which all parents could access and through which new parents were invited to participate in WFL. Targets were also set for the use of the instructional planner to support the development of the curriculum in the areas of Phonics, Creative Writing and Oracy. Each teacher was required to produce 3 lesson plans for each of these areas (9 lesson plans in total) by the end of January 2000. In addition teachers were expected to enhance and reinforce the use ICT integration in the curriculum while in the lab and in their classrooms by using the newly installed classroom PC's and new tools such as email, the internet, digital camera, scanner and WFL to enhance pupil involvement. Consequently during the academic year 1999/2000 there seemed to be no let up in what had to be done as teachers found themselves on a never ending merry-go-round involving attending WFL staff meetings, doing evening courses, working after hours both in school and at home preparing lesson plans, responding to emails and WFL project progress requests etc. As a result teachers began to feel extremely stressed and pressurized. As one teacher explained:

"The project created a lot of tension in the school because we were under pressure to get lesson plans finished by the deadline and we still had to teach. We had no time off. We were trying to do our own lesson notes and our WFL lesson notes after school, and we do have a life outside school, we have other commitments.We found it cut into our time very much. Even during break times and after school hours, everyone was talking about WFL. It just became obsessive."

Teacher 7

By the time I got involved with the project towards the end of 1999, tensions were already bubbling under the surface and with each passing visit to the school the tensions were mounting and intensifying. The instructional planner in particular was causing a lot of angst among teachers and a lot of concerns were surfacing in relation teacher/parent electronic communication. I could sense that the IT coordinator felt disillusioned as teacher resistance to the project began to emerge behind the scenes. This was compounded by the fact that she did not feel she was getting the support she needed from school management to drive the project forward. It was clear that something would have to give, which it eventually did when the IT coordinator resigned from her position as WFL project coordinator in June 2000 and thus sent the whole WFL project in the school into crisis.

What went Wrong?

A number of complex interacting factors were responsible for the way events unfolded at school four. For starters it has to be born in mind that school four had made a conscious decision not to apply for a SIP project and only reluctantly agreed to become involved in WFL. They had very good reasons for not wanting to be involved as I have already discussed. It's not that the teachers were lazy or indifferent. On the contrary they were a highly motivated, very dedicated group of people who were very open to new ideas that would improve the education experience of their pupils. My impression is that as a school they give a lot of thought to what they are doing and they won't take on any new initiative unless they feel they can give 100% to it. In their hearts and souls they knew they couldn't give 100% to WFL when they were already involved with another education innovation and in my opinion they were unfairly pressurized into taking on WFL. Allowing themselves to be railroaded in this way was clearly a mistake. Fundamentally the WFL innovation arrived on their doorstep at the wrong time and at that point in time this school simply wasn't ready for it. 'Readiness' as we know from Fullan (1991) is a key variable in determining the successful initiation and subsequent implementation of an innovation.

Another mistake was that they tried to do too much with WFL in one go. This was a three year programme so there really was no need to try to tackle all of the applications of WFL in the first year. A lack of project management experience among the project leaders was largely to blame for this. In addition a huge gulf existed between the ambitions of the IT coordinator for the WFL project and the rest of the staff. While she thought that WFL with all its attendant implications for change, parental involvement and teacher professional development was wonderful and embraced it with open arms, her views were not shared by the rest of her peers who were far quite fearful of the change implications of the project for their professional practices. Rogers' (1983) cautionary note rings true:

"Innovations often fail in organizations because change agents are more innovation minded than they are client oriented. They scratch where their clients do not itch.....Many change programs fail because they seek to swim against the tide of clients' cultural values without steering toward client perceived need. Change agents must have knowledge of their clients' needs, attitudes and beliefs, their social norms and leadership structure, if programs are to be tailored to fit the clients" (p. 321/322).

In other words change agents must be aware of their clients (sic. peers) needs and be prepared to adapt innovations and their own leadership style accordingly. This entails an ability to empathise with peers. This can be difficult for innovators who frequently lack a 'homophilious' orientation because they are more naturally 'hetrophilious' in their outlook. Rogers (1983) defines heterophily as the extent to which an individual differs from his/her peer group. As a result of this 'difference' innovators often experience difficulties influencing peers to adopt an innovation. Consequently they make poor change agents, particularly in traditional organizations where cultural norms tilt towards preserving the status quo. As the project leader for WFL, which was fundamentally a change oriented initiative, the IT coordinator's effectiveness as a change agent was greatly reduced because her leadership style was out of synch with the structure and norms of the system in which she operated.

To a large degree many of the difficulties experienced, stem from and were compounded by the school leadership. In the first place a strong leader would have stood up to the pressures being put on the school to take on the project. At the very

least once the school had agreed to take it on, the school principal should have adopted a pro-active, hands-on-approach to the project's implementation, particularly given the staff's initial reluctance to it. This did not happen. It's not that the principal was lack luster about the project. She was delighted to have the project and she attended all the WFL meetings, attended all the training courses and arranged block release time for staff so that they could work on different aspects of WFL. She just didn't appreciate the extent to which she needed to actively support this hugely ambitious and demanding project. As she herself did not use technology in her own work, the staff did not see her as a good role model in this area, particularly when she made no attempt to use WFL itself even though she attended the training courses with them. Some felt that the effort they made to use WFL was undervalued and unappreciated. The IT coordinator felt that she didn't get enough support from school management. A more pro-active principal would have reacted earlier to the problems emerging in relation to the project which probably would have prevented the crisis of the IT coordinator's resignation. The principal herself who was quite thrown by all that happened was quite frank in her assessment of what went wrong:

" I suppose I should use technology more myself and set an example and I should have allowed them to take on the project more gradually. I have asked the NCTE and IBM to provide more support for us for next year, because I found that the IT coordinator was very tired and stressed out after it all, this year. In hindsight maybe it was too much of a workload, for one person.....

The worst thing about the project? At times the amount of work that people had or felt they had to do, was enormously difficult for some of them. Our IT coordinator felt it overwhelming. Maybe we created pressures on her and on a personal level it was difficult for her and difficult for me too, to be honest.... I need more help to get change going."

Conclusion

In implementing any innovation and bringing about change, the leadership role played by the principal is crucial. As Fullan (1981) warns: "If the principal does not lead the development of an effective organizational process, or if he or she leaves it to others, it will normally not get done and change will not happen" (p.146). Similarly Berman and McLaughlin (1977) argue that it is the principals actions, not

what he or she says that indicates to teachers whether a change is to be taken seriously or not. However many principals like the principal in school four are unable to carry out a change leadership role because they do not feel prepared for or clear about how to carry out this task. While school four possessed many positive attributes that should have supported WFL's successful implementation such as a history of ICT usage, a reasonably IT literate staff, high staff motivation and an innovative track record, it was missing one vital ingredient, namely, a proactive principal capable of leading and managing staff through an extremely challenging change process. The absence of this ingredient in a school where the project should have enjoyed a lot more success than it did, (even though this was only the first year) supports the theory that the school principal plays a critical role in influencing an innovation's implementation and determining its ultimate success or failure.

Chapter 6

Case Study - The Thin Client School

Introduction

The Thin Client School and project case study is the subject of this chapter. As with the Wired for Learning school case studies in the previous chapter, both the names of the participant and of the school will remain anonymous. The school will be referred to as school six. The research methods employed in compiling this case study included computer laboratory observations of ICT usage, observations at staff training courses, school and project document collections and tape recorded in-depth interviews with teachers, the IT coordinator and the school principal.

Of all the research schools featured in this dissertation, school six is the school with which the researcher interacted the most, a factor that can be largely attributed to the willingness of the school to participate in the research. The case study narrative as described in this chapter will be analysed in greater detail in chapter seven. As in the previous chapter, this chapter will outline specific project information to enhance the reader's overall understanding of the thin client project and how the school came to be involved in such a technically advanced project, as well as providing a more in-depth look at the school and its interaction with technology. In the interests of consistency and where logic dictates, topic headings will remain similar to those featured in chapter five. However the order in which these will be dealt with will differ on the basis that this is a project which originated from within the school, as opposed to the WFL project which was externally generated. Therefore it makes more sense to deal first with the school context and environment to understand how this particular project evolved and then subsequently developed.

School Profile

School six is a medium sized senior primary school catering for children in the 8 – 12 age group. The school is coeducational and is situated in an affluent city suburb, 15km north east of Dublin City. The suburb has a population of about 10,000 and is split on an agreed catchment basis between two primary schools. The part of the

suburb from which most pupils originate was newly constructed in the early 1970's and the majority of children come from middle class backgrounds in the high socio-economic bracket. A survey carried out by students in the school in 2000 revealed that 98% of homes had PC's. There is very little unemployment in the area and most parents are very keen to ensure that their children receive the best education possible. Consequently the school is very well supported by an active parents association which provides additional funding to the school through fundraising events such as Christmas and Easter fairs, sponsored walks and raffles.

The history of the school parallels the history of the area. It was founded in 1977 as the middle class housing estates mushroomed and the suburb's population expanded. Like the site one schools, the school was founded by the state and the modern school building is attractively designed to reflect the ethos of the 1971 New Primary Curriculum. When first established the school had two teachers, the current principal and vice principal and the school quickly grew in size from a two teacher school in 1977 to a 22 teacher school with a student population of over 600 by 1990. However since then the student population has decreased significantly as the area has matured and the school now caters for 292 pupils.

The current teaching staff numbers 14, the majority of whom began teaching in the school during the 1980's. The school has a relatively high number of male teachers, seven in all, including the principal. The majority of staff members are in the 40-50 age bracket and are highly experienced teachers. As most staff have been teaching in the school for 15 years or more and joined the school during its start-up years, the staff profile overall is quite uniform. Most of the teachers, particularly the male teachers describe their teaching style as 'teacher directed'.

From my numerous visits to the school, it became clear that the school's ethos is predicated on the basis of continuous improvement, a willingness to innovate and a caring atmosphere within which a stimulating and progressive learning environment for pupils and staff can be maintained. Much of this ethos can be attributed to the leadership of the school principal who strives to maintain an open and friendly relationship with his staff and who encourages his staff at all times, delegates

responsibility where he can and sees himself primarily as a facilitator for other peoples talent.

"My job is to use the expertise of my staff, to affirm them , to encourage them and to make sure that there is good work going on...I learned long ago that authority is not about making decisions but enabling the correct decisions to emerge...I have always believed that if you can get a good atmosphere in the school, if you can get a sense of belonging, then you can get the best work from people. I think one of the things that has helped to create a good atmosphere here at the moment is the excitement attached to the whole idea of our SIP project".

In terms of leadership style, he definitely fits the 'initiator' profile. Personally I was struck by the fact that whenever I was in the school, the principal always joined his staff for coffee during the morning break in the staff room and the staff were very relaxed in his presence as he mingled among them and chatted informally with them. Break times were always a relaxed affair in this school and there was always a great buzz in the staff room as people chatted and joked with each other. The sense of cohesion and the healthy personal relationships that existed between the various teachers and between them and their principal was obvious, even dare I say it, infectious, to the point where within a very short time I began to feel almost a part of the staff myself.

The open and innovative culture that characterizes the school manifests itself in a number of ways. While I was there, the school was involved in an EU Comenius project involving a variety of pupil projects and teacher visits to partner schools in Greece, Spain and Italy. The school, like school four in the WFL project, was one of a small number of schools involved in piloting the teaching of a European language at primary school level. Each year the school hosts an American student exchange on behalf of a local teacher education college and participates in an exchange of students with a school in Northern Ireland. An openness to parents and visitors , of which I was one of many, and a high level of community involvement is further evidence of the school's open and innovative orientation.

History of Computing

The history of computing in school six can be traced back to as early as 1988 when the school purchased its first computer. This early venture into computers is but another example of the school's willingness to innovate and continuously improve the learning environment. It was prompted both by the enthusiasm of one teacher with an interest in computers in education and the principal's ability to recognise and capitalise on this enthusiasm for the benefit of the school. At a time when pupil numbers were due to start falling rapidly, the principal was looking for ways of making the school more attractive to parents of potential pupils, and he identified IT as a specialty area that the school could develop.

"One of the reasons why I decided to get the school involved in computers ten years ago was that I could see our enrolment was declining and one of the consequences sometimes of a decline in enrolment is a decline in enthusiasm. So I was looking for some little edge, and although it was ironic coming from someone like me who is a computer illiterate, I knew that I had Ken [not coordinator's real name] on staff and I thought about how I could marry the two. So that's basically why when Ken came along initially with his ideas and his enthusiasm about IT, he was pushing an open door. But I wouldn't have allowed Ken to push the door as wide if I didn't think it would be in the best interests of the school, and in an area like this, it was a nice thing to have as well for the parents and the teachers and also the children."

Principal, School 6

Although the enthusiastic teacher had spoken to the principal on many occasions in relation to developing an ICT policy and infrastructure for the school, he was, by his own admission, genuinely surprised when the principal approached him with a view to initiating the introduction of computers into the school.(SIP 041 final project report, p.8). Nonetheless he enthusiastically responded to the challenge and was quite happy to take on the extra responsibilities that it entailed even though it was not an official 'post of responsibility' and therefore did not qualify for extra remuneration or seniority. From this point on the enthusiastic teacher assumed the mantle of unofficial IT coordinator for the school, a role which he performed admirably for ten years without recognition or reward, until finally in 1999, while he was developing the schools SIP application for the thin client project, a 'post of

responsibility' became available for the school. It was decided to allocate that post to ICT and following interviews, he was officially appointed as the ICT coordinator.

In 1988 when the school first embarked on its computerisation roadmap, a sum of £1,200 (£1,523) was allocated from the school budget to initiate the process and additional funding was undertaken with help from the parents association to provide for additional resources. Without this additional funding it is extremely unlikely that the school could have achieved a level of ICT provision within the school as funding from the Department of Education at that time was non-existent. Since 1996 the school has added an extra £5 (£6.35) to every child's booklist to help with the costs of maintenance, updating and purchasing of new software. Significantly parents supported this additional charge because they were delighted to see the progress that the school was making with IT. As things stand today the school is known throughout the area as an IT school which is a source of pride for both the school and the parents.

The first target group identified as most needing IT was the Special Needs class and initially the computer equipment was directed at this class as it was felt that these students would benefit the most. Over the next few years progress was slow and tedious as the school progressed from one computer on a trolley, going from one classroom to the next, to two computers, four computers, until eventually by 1994 the school had six machines, two printers and a modem. All the computers were Acorn desktops. At the time all the software was floppy disk based with some programs requiring up to four disks. Each computer had its own trolley and disc box with up to 40 disks in each box. They were all colour coded according to what computer/box they were supposed to stay with, but invariably they became either lost or redistributed and had to be recopied and relabeled. For the IT coordinator this was a never ending task but one which did not overly frustrate him as he felt at least the staff and pupils were using the computers.

In 1995, the school made a bold step forward by purchasing five extra computers, some of which were second-hand and nine network cards. This brought the number of machines to eleven and as some of the older machines had been upgraded the previous year, it was decided to set up a small networked computer laboratory, in a

small meeting room, which was under utilised. The room was fitted out with additional electrical points and work benches and a LAN was set up using one of the computers as a sever. For the IT coordinator it was his first experience of networking and it involved a steep personal learning curve. But he persisted with it as he soon learned that the problems of maintaining a LAN were far outweighed by the simplicity of managing software, printing and centralising resources. Around this time an additional two stand alone desktops were also made available in both the principal's and secretary's offices.

Between 1996 and 1998 a further six computers were acquired. One was newly purchased , three were purchased second hand, two were donated to the school and one was won in an Art competition. Five of these machines were added to the network, whilst the sixth machine became a free floating device, located on a trolley and available for classroom use as needed. The school now had 16 PC's available for teaching purposes, 15 of which were networked. The network consisted of a mixture of Acorn and windows based machines.

In 1999 as a result of a successful Sip application the computing resources in the school have now increased to an unprecedented level and the computer infrastructure has been totally transformed utilizing thin client technology. The school is now equipped with a computer lab consisting of 30 machines linked to a thin client server network. All classrooms now have a networked thin client desktop or multimedia PC's with internet access. In addition the special needs classroom contains an independent network of 7 computers equipped with specialist software and learning. The remedial classroom also has its own network of 4 computers. In all there is now a total of 56 networked computers in the school. When I made a return visit to the school in March 2002, the school had recently purchased a dedicated video editing computer and a digital camera for the purpose of encouraging 6th class students to create their own digital content and movies.

School ICT Usage and Policy Development

This history of the school's technical progression however does not reflect fully the broader picture in relation to the school's use of ICT, under the guidance of the IT coordinator, for the enhancement of pupils and the primary school curriculum. From the earliest days of its ICT involvement, the school has always believed in planning its next step and was constantly looking to the future, trying to foresee what would be needed. For this reason the school has had an ICT policy since the early 1990's and from this it developed and refined its plans as resources became available. It was keen to ensure that every child was catered for equally within the school regardless of age group, gender or academic ability. To achieve this appropriate software was purchased for all levels and it became school policy to allocate a time slot to each class of an hour and a half each week for IT and to assign certain software for use with each class. The school's Special Needs children were allocated additional resources, as the school believed very strongly that the benefits of computers in education were even greater for these children. This emphasis on special needs has continued to the present day and it is seen as one of the school's great success stories.

During the period from 1988 to 1998, the school had taken part in many innovative projects that directly involved its pupils using computers in imaginative ways and broadening their view of learning. It was one of the first primary schools in the country to get internet access in 1990, when it participated in a project known as NITEC, run by Dublin City University, with the purpose of getting schools to communicate using the internet. There was no WWW in those days, only email and FTP, so everything was text based and quite complicated. In 1991 the school also participated in a pilot study of six Irish primary schools using email in a project for the Department of Education. They also communicated with schools in the USA at the same time and developed a year long project with a school in Vermont. In 1992, while teaching 6th class students, the IT coordinator encouraged and facilitated his class to produce a multimedia project on the local area, which is still in use as an educational programme on the school's network to day. Two years later, in 1994, while teaching 5th class, his students created a multimedia project about the bog ecosystem entitled "Save our Bogs". This project won the overall award at the

Computer Education Society of Ireland (CESI) fair in Dublin City University. This program is still used each year as part of 5th class geography studies.

In 1995, Jean Kennedy Smith, the then American ambassador to Ireland, launched the "Globe Program" in Ireland from the school. School six was the only primary school out of eight schools involved in this project and two teachers had to train over two weekends in their own time as "Globe Teachers". This project is still in operation in the school today and it involves children acting as scientists and taking precise readings each day of temperature, rainfall and cloud cover. These readings are transmitted to Globe Central in Boulder, Colorado using the internet. They are also shown on a weatherboard in the school's main hallway along with a current satellite photo of cloud over Europe.

In 1996 the IT coordinator developed the school website, with a lot of involvement from the children in the school. Every year different teachers have produced class magazines, confirmation commemoration booklets, projects, electronic artwork and have been involved in internet project in distant countries. All of these educational computer projects illustrate the increasing engagement with technology by both pupils and teachers.

The IT Coordinator

Like the IT coordinators in the three primary schools in the WFL project, the IT coordinator in school six was a senior member of staff with over twenty years teaching experience. I would have to say however that in terms of technical know-how, expertise and interests he was light years ahead of all the other IT coordinators, and it is probably true to say, light years ahead of any other IT coordinator nationally. But his expertise is not simply confined to his technical prowess, as he is only too aware that there is no point in having technology for technology's sake. His love of technology is married to a vision of how technology should be used to enhance the teaching and learning environment.

The knowledge and expertise of the IT coordinator has been instrumental in developing a school ICT policy to determine the direction of ICT development

including staff development, and in maintaining the school network. The principal attributes the current SIP project almost 100% to the IT coordinator's enthusiasm. It was clear from my time spent in the school, that the principal and IT coordinator enjoy an excellent and very close working relationship. It was also clear that the IT coordinator is very popular with all staff members who hold him in very high esteem.

He is also held in high esteem by the wider education community where he has acquired a reputation for his IT expertise. Over the years he has been involved in many pilot projects in IT nationally and his expertise has been consistently leveraged. He has assisted the Irish National Teachers Organisation (INTO) in developing their policy document on ICT in education and when the INTO launched their 'Magnet School' program he was instrumental in acquiring this status for his school. He has beta tested various software programs for software production companies as well as a project for the Department of Education and BOCOM during the 1990's involving the transmission of web content to schools over TV signals. When the 'Schools IT 2000' program was launched, he was invited to assist in the design of the national Phase One Introductory course and has acted as a "Key Tutor" for the NCTE which involved training tutors for this course and the Phase Two training courses. He has also lectured on ICT in education to 3rd year students in the main national teacher training college and assisted them in developing their first such course.

In many ways, the IT Coordinator fits the typical 'innovator profile' as outlined by Rogers (1983) who described innovators as 'venturesome', 'eager to try out new ideas' and capable of 'understanding and applying complex new ideas'. In accordance with Rogers' theory, such individuals are more 'cosmopolite' than other members of the social system and are more likely to network with others outside their social system. In the case of this IT coordinator his networks extend out not just into the wider education community, but also into the broader community of the IT industry with whom he had established links over the years. As a result when he sat down to devise the 'Thin Client Solution' SIP project, he was able to leverage these industry contacts not just for advice and support, but also more importantly for sponsorship and financial assistance.

Thin Client – Project History

For some time prior to the announcement of SIP, the IT coordinator was researching how best to advance the school's ICT facilities in order to create a more modern, easily maintained, networked system of computers and to encourage greater usage of the system by students and teachers. He was only too aware that the school's existing network was restrictive in terms of space, access and the ability to deliver internet capabilities across the school. In addition teachers were frequently complaining about the cramped space of the existing lab, poor ventilation and the numbers of children sharing a computer. Teachers found the ratio of three children per computer very restrictive as it could only be achieved by squashing the children tightly around each machine. As a result children were constantly complaining that "I didn't get my turn" or "I hadn't time to complete my story", and some teachers cited the 'unfavourable conditions' as the reason why they were reluctant to regularly bring their classes to the lab. However as most teachers had shown an interest in and a willingness to learn about technology through their attendance at various ICT courses over the years, the IT coordinator believed that they deserved a system that would free them from many of the restrictions of the existing network.

While researching what kind of a system he ought to put in place, the IT coordinator came across the concept of thin client technology on the web and began researching the use of the NC in conjunction with Citrix Metaframe software solutions. He became convinced that this combination held great potential for a school based network and he discussed it with some of his industry contacts, who also convinced him of its potential. On this basis, in May of 1998 he invited Acorn's technical team to come over from the UK to demonstrate their network computers using Citrix Metaframe to run Windows software. He organized this demonstration in the school hall and invited DES officials, INTO personnel, NCTE tutors and principals and teachers from all local schools to attend. More than one hundred people attended the demonstration and although the system was still in its infancy, so much so that the demonstration was using a prelease version of the software that was still being tested, the IT coordinator became convinced that this was the way to go. Later that year his efforts and research endeavours paid off when the SIP

initiative was launched and he submitted a proposal to pilot the use of the thin client platform in the school. The "Thin Client Solution", as this project became known, was approved for funding in March 1999.

School Support for the SIP Project

As the SIP project entailed a total transformation of the school's ICT infrastructure and impacted directly every pupil and teacher it required the approval of the school Board, the principal and all the staff prior to submission of the application. Having convinced the principal of the potential benefits, a steering committee comprising the principal, another member of staff, a parent with experience in the IT industry and the IT coordinator was formed. This group assisted in putting together a plan for the development of ICT in the school based on the proposed new infrastructure. When it was finally on paper the committee approached the staff at a meeting and outlined the plan to them and what the SIP project would entail. The committee highlighted the benefits that would accrue from the new system but were also upfront about the support and commitment that would be required from them as a staff. After some discussion it was agreed to support the school's application for SIP.

Industry Sponsorship

During the project application phase, the IT coordinator used the expertise of his contacts in the IT industry, one of whom included a school parent who had previous experience with Citrix, to help him scope out and cost the system. A local company, Technico also agreed to provide sponsorship as did another company, AGFA. Shortly after the project was approved for SIP funding, the SIP national coordinator contacted the IT coordinator to see if he would meet up with Microsoft who had apparently expressed an interest in this project on examining the range of projects that had been approved under SIP. He agreed to do so and shortly thereafter he attended a very formal meeting at Microsoft's headquarters in Dublin where he was closely questioned about the project by two of their technical experts, the sales director and their education representative. He was delighted when at the end of the meeting they agreed to fund the project directly with €38,000 towards hardware and the equivalent value again in terms of software licensing. They also agreed to assist

with any technical support required. This unexpected sponsorship was a major boost to the project which enabled the design to be implemented in full and in one phase.

Teacher Release Time

As part of the SIP project the IT coordinator was allowed a total of 61 days released from class with full substitute cover for each of the two years of the project. This was a key element in the success of the project in ensuring it attained its aims and objectives. Effectively this meant that the IT coordinator was released from classroom duties for two full days each week when a local substitute teacher took over his teaching. Obviously though as 'class teacher' he still maintained overall responsibility for his class and each child's progress. This juggling of responsibility for both his pupils and for a very ambitious and pioneering project was quite stressful and privately the principal expressed concern that the IT coordinator was working so hard that he was heading for a heart attack. The IT coordinator's initial request had been for a year free from class entirely and in this case, given the technical complexity of the project, this probably would have been more appropriate.

During his teacher release days, the IT coordinator performed a huge range of tasks from maintaining and developing the system to delivering training and supporting teachers in using technology whenever he could. He also facilitated many visitors, including myself who wished to view the project and seek his advice. Visitors included both other schools seeking to set up their own networked systems and Education Ministers and officials from overseas education departments who were invited by DES to view the school's IT set-up as this project was in many ways a 'showcase' for the success of the 'Schools IT 2000' initiative. As a result seldom a week went by without a visitor of some nature visiting the project. When I interviewed the school principal at the end of the first year of the project, he expressed concern about the amount of time that the IT coordinator had spent facilitating so many visitors, time which he felt could have been more productively spent with teachers in supporting and encouraging their IT development. This is a valid point and indeed some of the teachers themselves in the course of the interviews said that they expected the ICT coordinator to be more available to them

than he was during that first year. This is where the extra release time that the IT coordinator initially requested would have been very useful and beneficial.

Staff Training

There has been a high attendance by teachers in school six at ICT based professional development courses since the first computer arrived in the school. Teachers have attended courses provided both internally by the IT coordinator and externally by the NCTE as part of 'Schools IT 2000'. It is estimated that most teachers have attended an average of six such courses in the past ten years.

Long before 'Schools IT 2000' arrived the IT coordinator had been conducting whole staff training on the use of computers with his own staff. These courses were developed by the IT coordinator with funding from the In Career Development Unit (ICDU) in the Department of Education. It was part of the school's policy to constantly train staff and try to ensure that such training was targeted with 'what to do with your class' objectives in mind. Since 1992 an ICT based course has been provided for staff each summer. In 1996 and 1997 two full evening courses each consisting of two hours a week for ten weeks were run. These courses focused on educational software and how and where it might be used in the curriculum. All but two teachers in the school attended these courses.

Since then with the arrival of 'Schools IT 2000', staff have attended at least three further courses – "Phase I Introductory Course" from the NCTE, "Integrating ICT into the New revised Curriculum" from the INTO and a special SIP course that the IT coordinator adapted from the NCTE's "Internet and "Basic Troubleshooting" courses. This latter course, which had to be adapted from existing courses because of a lack of training material that would be relevant to the schools thin client system, was a twenty hour course involving staff staying behind for two hours one evening per week for an entire term. It was strongly supported by staff with eleven out of the fourteen staff members, including the school principal attending it.

Over the years the emphasis put on training as part of the school's ICT policy has been rooted in a belief that teacher training is the cornerstone of any change in teaching practice or teacher thinking in relation to ICT. Since the arrival of the SIP project, and the school's new ICT infrastructure, staff have requested that some time be allocated at the beginning of staff meetings each month for the IT coordinator to demonstrate new software and to give advice and solutions to difficulties encountered. The IT coordinator believes that this is a huge step forward and evidence that "at last they are the ones driving their own ICT development and not me" (SIP Final report, p. 29).

While most staff have attended training, two teachers in the school have consistently resisted attending such courses and are reluctant to engage with technology in any meaningful way. No pressure has been put on these staff members to change their stance and there appears to be an open acceptance of their reasons for not wishing to become involved. Furthermore their resistance would not appear to have created any undue tensions among the staff and when I was first introduced to both staff members by the IT coordinator, he light-heartedly introduced them to me as 'our IT skeptics'. In the case of the female teacher family commitments have hindered her attendance at training courses and hence her adoption of ICT, although she also has philosophical reservations about the use of ICT in education. In the case of the male teacher he does not utilize ICT for teaching purposes on the basis that it is not formally required as part of the primary school curriculum. Interestingly, although both teachers take their class to the school lab on an intermittent basis, their reasons for so doing have more to do with the pressure put on them by their own pupils rather than any pressure emanating from fellow teachers, the IT coordinator or the school principal.

Reaction to the proposed research

As with the Wired for Learning Schools, the SIP national coordinator wrote to the Thin Client school in mid October 1999, informing them that I would be in contact with them with a view to potentially conducting research on their project. This letter was followed up with a phone call from me to the IT coordinator in the final week of October 1999. Interestingly in this situation the SIP national coordinator only gave

me the name and telephone contact number for the IT coordinator and did not give me any contact details for the school principal. When I rang the IT coordinator to explain to him my research and what I was hoping to achieve, he was very positive, encouraging and open to the idea of meeting up with me as soon as possible. On this basis a meeting was set up for the following week and reflecting back on it, it is interesting to note that in this instance there was no mention of 'protocols' or 'having to clear things through the proper channels'. In fact the notion of the principal's permission never entered the equation. Clearly here was an individual who felt empowered in his role, a fact which in itself speaks volumes about the school's ethos and culture and the principal's style of leadership.

The first meeting

My first meeting with the IT coordinator at the school took place on the first week of November 1999. The school is located on a quiet, private cul-de-sac which also houses the junior primary school. The journey to the school takes one through a number of affluent, modern housing estates. On entering the school, which is a bright, modern building, the first thing one notices is the number and variety of student projects and artwork decorating the main school corridor. Much of this material has been electronically generated indicating the extent to which ICT has been integrated into the school's teaching and learning activities.

On arriving at the school, the secretary contacted the IT coordinator who almost immediately arrived in the main corridor to greet me and from there we went straight to the computer annex room, located off the main lab to begin our discussions. There was a class working in the computer lab at the time. During the meeting the IT coordinator outlined in detail the current SIP project, the history of the school's involvement with IT and also gave me a detailed tour of the computer lab when the class vacated it.

My first impressions of the lab were that it was very impressive, professionally designed and well thought through and laid out. It was also very quiet, as there was little or no machine noise and there was very little clutter as the sleek thin client boxes took up very little space. The specially designed work benches and the colour

coordinated grey worktops and purple 'typist' chairs coupled with black blinds to block out incoming light gave the room a pleasant and restful look and feel. In terms of layout, the room had an island section in the middle which contained approximately six machines on either side and the remainder of the machines were located against the side and back walls of the room in a horseshoe shape. There was sufficient space for the teacher to comfortably walk around the room and interact quite easily between those located on the island section and those located against the wall. The teacher's desk, whiteboard and data projector were located at the top of the room.

With the tour of the lab completed, the IT coordinator then invited me to join the staff for their morning tea break during which I was introduced to the other members of staff. It was here that I first met and was introduced to the school principal. The atmosphere in the staff room was relaxed, warm and friendly and straight away I was made to feel very welcome and at ease by both the principal and the staff. On my many return visits to the school I noted how the relaxed and pleasant atmosphere of the staff room was complemented by the physical arrangement of the room itself in which a full length window located at the rear of the room flooded the room with bright sunlight for most of the day. In addition low comfortable chairs and low round coffee tables located in a linear fashion adjacent to each other helped to create a physical space which was not just relaxing, but which was also conducive to on the one hand, small cluster groups forming when people wanted to interact with each other, and on the other hand, the formation of one large group if someone had a special announcement to make or wished to begin a discussion in which everyone could participate.

During subsequent visits to the school I became aware also of how open the staff room was to pupils. Whenever pupils knocked on the staff room, which they frequently did during break times, they were immediately invited into the staff room. They were never left outside to wait for a teacher to go out to them and I noted on a number of different occasions when I was alone in the staff room that children seemed to wander in quite freely, usually for a drink of water. There appeared to be a genuine affection between the pupils and the staff and it was not unusual to come across the principal or one of the teachers openly sharing a joke or funny moment

with pupils in the corridors or to see the younger pupils or special needs children nudge closer to a teacher in search of an affectionate affirmation. In many ways, the 'artificial' barriers which frequently exist between teachers and their pupils did not appear to exist here which in turn added to the cohesive and caring culture which permeated the school.

Obviously not all of these details were apparent on the first visit to the school and yet even on that first visit I detected an openness about the school and a willingness to welcome and facilitate outsiders. Before leaving the school that day, I was given, unsolicited, a bundle of photocopies containing all documentation relating to their SIP project since its inception which included their original application, a breakdown of costs, the project's aims and objectives and the School's ICT plan. It was also agreed that I would commence observation studies of ICT usage in the lab on one morning a week effective from the following week, for an unspecified period of time.

School Visits and the nature of Computer Use

In School six, each class is timetabled for one and a half hours per week in the computer lab and each teacher is encouraged to bring his or her class to the lab for that period. No class is scheduled into the lab for one afternoon each week so that teachers who wish to do additional computer work with their class can book this slot. In all I conducted twelve school visits during the period November 1999 to the beginning of April 2000. As a result I conducted nine observation studies of ICT usage in the lab involving one 3rd class group and two 6th classes. These sessions took place on the same morning each week for a three hour period during which time I observed the 3rd class followed by the 6th class with each session lasting one and a half hours. I also conducted a further session which involved spending one morning observing a 4th class first in their own classroom and then in the lab as they worked on a 'Vikings' project and visiting the remedial room to see how computers were being used by children with learning difficulties. The remaining two visits involved attending teacher ICT training which was delivered by the IT coordinator. During each visit I also had the opportunity to spend some time with the IT coordinator discussing project progress, thin client technology and other IT related

matters of educational significance. These conversations were always a rich source of information and debate which provided some wonderful insights into the IT coordinator's in-depth knowledge of IT and his commitment to the role of ICT in education.

From these visits it was clear that the general level of student and teacher ICT use in the school is quite high. There is a wide variety of software packages available on the network ranging from drill and practice software to problem solving and adventure and simulation packages to support a range of subjects such as Maths, English, Geography and History. A variety of WP and desktop publishing packages such as 'Ovation', 'Edit' and 'Textease' are available to support the writing process while an open learning tool entitled 'Junior Pinpoint' is used to teach children how to conduct surveys and analyse and display data using bar charts. A number of drawing packages such as 'Dazzle', 'Paint', 'ClipArt' and 'Draw' are used to support the teaching of art. The IT coordinator was very cleverly using 'Storymaker' with his 5th class pupils to support the learning of the Irish language with which many children of this age group have difficulties. He would only allow them to use this package to create stories in Irish and as this was a multimedia package, to which they could add sound and music, which the children enjoyed doing immensely, he saw this as a way of stimulating their interest in a subject that they often found hard to master and difficult to be interested in. Although I did not conduct any observation sessions of his computer classes he gave me copies one day of some of the stories which his pupils had constructed using 'Storymaker.' What stood out from these printouts for me was the quality of both the visual and narrative continuity of these storylines compared to what I had seen at the Wired for Learning school i.e. school one, which was also using 'Storymaker.' Granted the pupils here were two years older than those I had observed in school one but the difference cannot be solely attributed to this fact as I know from my discussions with the IT coordinator at school six that he won't let the pupils use 'Storymaker' until they have first sketched out on paper a storyboard of how they see the plot developing. So although he was ostensibly using the package to develop language proficiency, he had a much broader appreciation of how a multimedia package like this should be utilized to support the development of a range of other skills.

Other uses of ICT in the school include the use of computers to produce class magazines, booklets for special occasions and projects in different subject areas. In addition the internet has facilitated a range of activities by both teachers and students including project research and email projects with schools abroad. A selection of students' creative writing, poetry and artwork are also published on the school website.

Although during the course of the interviews some teachers expressed a need for greater coordination between the types and levels of computer used by different year groups, the school ICT plan contained a blueprint of the type of software suitable for different classes. As a result the emphasis for third and fourth classes was on the use of software to support maths, reading and problem solving. To this end packages such as 'Maths Circus' and 'Space Table Aliens' which emphasize tables, shapes and angles deploying a game type format were utilized. 'Granny's Garden' and 'Matti Mole' were also used to support the development of logic, reading and memory skills. The teaching of Geography was supported by software such as 'Kingfisher Micropaedia', 'Around the World in eighty days' and 'Eire'. Packages such as the 'Egyptians' and the 'Vikings' were used to support history and the development of project work.

In one of the 4th classes that I observed the teacher used the class time to develop Viking artifacts such as Viking boats, Viking towns and Viking helmets from cardboard and papier-mâché. Then, when the children went to the computer lab later that morning, they used the 'Vikings' CD-ROM to find answers to different aspects of Viking life and adventures based on a computer generated worksheet that the teacher had produced for them. According to the teacher, use of the computer software enhanced the learning experience for the students and made it easier for them to see and understand the lifestyle of the Viking period:

"We did a lot of project work on the Vikings using the CD-ROM and I would say the children became far more aware as a result. Sometimes if they look at pictures in books they are not as conscious, but with the CD they could see the thatch coming down, they saw the characters moving, the characters basically talking to them. As a result I think it became clearer to them how the weaponry, how the helmets worked with the nose protector and just the style of life of the people. They could actually hear

them speaking the language and a lot of the students were saying – ‘they’re speaking Irish’, and I was saying – ‘that’s not Irish, it’s Danish’ or whatever their own language was. From that point of view it did help a lot”.

Teacher 1, School 6.

Fifth and sixth class students were exposed to a broader range of ICT based activities and were encouraged to use problem solving adventure type software such as ‘Spy Catcher’ and ‘Crystal Rain Forest’. They also used multimedia creation packages such as ‘Magpie’ and ‘Storymaker’ and have participated in email projects with children in schools abroad. Sixth class students were also involved in producing the ‘Confirmation booklet’, in maintaining and updating the school website and in gathering data for the ‘GLOBE’ project.

In the ‘Special Needs’ and ‘Remedial’ classes packages such as ‘Starspell’ and ‘Wordchart’ are used to reinforce the teaching of words and spellings while ‘Space Table Aliens’ is used to reinforce the teaching of tables. A software package entitled ‘Talking Clocks’ is used to teach the children the time. For the special needs teacher this particular package is worth its weight in gold and has simplified the task considerably:

“ I have always said that the computer in my room is as good as another teacher. I was teaching time there last week and I could go into the talking clocks and pick exactly what I wanted. We were doing the hour and half past the hour and I could do it exactly and I could pick it exactly and I could set up the computers and see could they get the 10 out of 10 out of talking clock from just using it. I did them in sequence first and the motivation they had to get that 10 out of 10 or whatever was great. Before computers I would be winding clocks around for ever and a day and I had different clocks made for them and they had their clocks over at their desks. So I couldn’t say enough about computers.”

Teacher 7, school 6

Software tools such as ‘TextEase’ and ‘Stylus’ are also used with the Special Needs children to assist them in creating short stories and adding pictures to text. The teacher believes that the students have benefited enormously from the use of IT to

support language development, writing and motor skill dexterity and acknowledges that the computers are like 'her right arm', without which she would be 'totally lost'. As a result of the emphasis put on the use of computers for special needs children since the school's earliest involvement in IT and the individual tuition which they receive, the IT proficiency of many of these students is quite high and in the opinion of their teacher more advanced than that of other students in the school.

"These children are absolutely incredible. Every child except one can open up a page, frame the page, select the size of the print, select the clip art, drop it in and print it. And these would be children who can't write but they can produce their own work on the computer....When I come in in the morning I find they have the computer ready to roll, their page set up ready to go and they want me to write it out for them on a copy so they can type it up and then collect the printouts...They know how to save into their own file and how to go into their own file. I think in comparison to some classes they would probably put them to shame in that they know everything about it, know how to get in and around the computer, but then I have time to teach them in a smaller group situation."

Teacher 7, School 6

Discipline in the Lab

Like School four in the Wired for Learning project, I noted from my observations that the school approach to discipline in the lab was quite relaxed and laissez-faire. Although noisy, the children were never disruptive despite the fact that they were free to wander away from their machines to check out what other students were doing, to lend a helping hand to others or to seek assistance from their peers. In most cases they were free to open up the designated computer program for the day's lesson on the desktop at their own pace without having to wait on directions from the teacher. Students who completed their tasks ahead of others were allowed to open up other programs of their choice on the desktop or in some cases, play games. Some teachers even allowed all children to play games for the last ten minutes of scheduled lab time. Because the network printer was located in the lab, children from other classes were constantly walking in and out of the lab to collect class printouts. The lab was never locked and during lunchtime pupils were free to use the lab unsupervised to do some additional computer or project based work.

On entering the lab students freely moved, or should I say rushed over, to a machine of their own choice without having to enter in line. On exiting, although they lined up in pairs, they were never required to remain silent but they were encouraged not to make too much noise and disrupt other classes. From what I observed teachers rarely stood at the top of the class to direct student activities but rather spent their time walking around from student to student located at each machine to check on progress. Because of the amount of computers in the lab, 30 in all, most children had their own computer to work on, a situation that both teachers and students liked. However where class number exceeded thirty as it did in the case of the 3rd class, some students had to double up. Also when technical difficulties arose, usually as a result of a 'time-out error' problem, which caused a handful of machines to crash when the traffic on the system became too heavy, a number of students would have to work in pairs. This was a source of annoyance for both teachers and pupils. The students in particular didn't like having to share while teachers found the class easier to manage when each child had his/her own machine.

As with the Wired for Learning primary schools, the younger the child, the more challenging the organisational and management task for the teacher, and the noisier the class. By the second term the 3rd class teacher had rather innovatively resorted to a P.E. whistle as a way of getting the children's attention in the lab when she needed to address them as a group. The children clearly enjoyed their computer time and the freedom from the normal classroom restrictions which it entailed. They frequently expressed disappointment when the lab sessions were completed and asked if they could stay longer. On one occasion when one computer lab session was prematurely ended so that the children could attend a concert in the school hall by visiting musicians, the children asked if they would be able to return to the lab after the concert was over. They were most disappointed when the teacher informed them they could not. Overall then as a result of the relaxed approach to lab discipline, the learning environment in the lab was open, laid back, free and easy and supportive of children's chatter and social needs.

Children's interactions with the Computer

During my lab visits to the school, the class which I observed most frequently was a 3rd class. They were in the lab every week as scheduled whenever I arrived. Their teacher was among one of the younger members of staff, albeit with 18 years of teaching experience behind her. She herself had young children of primary school going age and had recently purchased a home computer for her children. For the benefit of her students she was keen to use the new facility and enthusiastic about taking them to the lab even though by her own admission she did not know exactly what she was hoping to achieve with them while in the lab nor felt completely in command of the technology.

"I just barged in last September and I wanted to do it and I said we would talk our way around it even if we haven't got the lingo...I really didn't know why I was there but I just said I'm going to take the 3rd class group plan that the IT Coordinator has worked out and I'm going to do it and make it part and parcel of the school week. Now it probably wasn't a good strategy but at least I got myself going and over the year I have pulled myself up a little bit."

Teacher 2, School 6

I find this comment interesting as it sheds some light on two early comments I made in my early observation notes during the first term in relation to:

- The fact that the enthusiasm of the IT Coordinator for ICT did not seem to have transferred to other members of staff and consequently my early impression was that within the context of IT, he was effectively operating as a "one-man band" with few other members of staff sharing his level of enthusiasm for and commitment to technology. This comment needs to be understood in the context of my initial observations with what I saw as a big gap, between on the one hand, the IT coordinator's technical expertise, a top class state of the art IT infrastructure and the school's long history of IT involvement, and on the other hand, the fact that many teachers were unsure about how to apply the technology to their teaching to achieve effective learning outcomes in the lab. In hindsight I feel my initial expectations were

too high and as the IT coordinator frequently reminded me “I think our reputation is greater than the reality”. In raising this issue I am in no way attempting to undermine the past achievements of the school in terms of its ICT development but rather attempting to illustrate just how complicated the process is and the amount of time and effort required to build up a school-wide competence in ICT. This is an issue I shall return to again in the next chapter.

- The fact that I found it difficult as an observer to appreciate what was really going on in the lab in terms of understanding what kind of learning was taking place and what the aims and objectives of the lab sessions were. The fact of the matter was that the teacher herself was operating on a bit of a wing and a prayer and there was no real structure or plan attached to what she or the children were doing. This is not to suggest that the exercise was pointless. On the contrary from the teacher's point of view, it was very beneficial because she was embarking on a learning curve of incalculable value. A learning curve which involved getting one's hands dirty with the technology, having the confidence to give it a go and a willingness to conduct the lab sessions on her own even though the equipment and setup was totally new and the fact that she felt ‘she was only one step ahead of the pupils herself’. Like many other teachers in the school she had come to realize that the only way to become competent in this medium was through using it. *“It's a bit like driving a car”, she said to me one day, “you can have your lessons [sic training] but unless you then go and drive the car, the lessons are no good because you forget everything.”* My classroom observations commenced just as she and other teachers in the school had finally acquired the confidence to begin driving that car.

It may seem that I have digressed somewhat from the purpose of this section, namely children's interactions with the computer, however the aforementioned points are important to a contextual understanding of much of what I observed and my reflections on those observations.

Over the two terms that I observed the 3rd class lab sessions, the children worked on two packages, ‘Matti Mole’, an interactive CD-ROM to support language skill

development and 'Granny's Garden' an interactive package designed to develop logic and problem solving skills. In the early days one of the first things I observed were the organizational and management difficulties involved in getting 35 nine year olds seated at their computers and focused on the task in hand. Invariably there were also technical difficulties to contend with during the log on period and this compounded the task for the teacher. As a result it usually took at least 15 minutes at the beginning of each session to deal with these issues before the class settled down to tackle the day's lesson. Because the class was so large and so young I felt a number of interventions would have helped to eliminate much of the time wasting that occurred at the beginning of each session such as:

- A clear basic typed up 'What to do sheet' for each child to follow as he or she logged onto the desktop and loaded the software for the class session in order to streamline the process and make it more efficient.
- Training for children in basic IT skills such as how to turn on the machine, understanding the desktop interface, mouse manipulation skills and keyboard basics. Many of the children simply didn't know the basics and this slowed up the logging on procedure considerably.
- A teaching assistant who would work alongside the teacher in the lab. On many occasions I ended up performing that role as the teacher got sidetracked with students experiencing technical, software related or learning difficulties and I attended to the needs of other students who had questions and queries. From being in the lab and observing at first hand the different tasks which the teacher is required to perform one begins to appreciate how difficult it really is for one adult to manage 35 lively, noisy nine year olds and thirty machines. Informally the teacher herself told me that she felt there were too many in her class to make the best use of the lab time and that she would also prefer if every child had his/her own PC to work on in the lab.

When the children finally got to work on the software, they seemed for the most part quite focused on the task in hand and eager to move through the different sections of

the software package. After a while however I began to realize that in many cases a big gap existed between their apparent progress and their actual achievements. When using 'Granny's Garden', I noticed that a substantial number of children got stuck when they had to develop a strategy for rescuing a character called 'Lucy' from the dragons. To rescue Lucy students had to work out the favourite food combination for each of the four dragons. This involved logical thinking skills. Once they had worked out the favourite food combination for each dragon they could pass the appeased dragons unharmed and rescue Lucy. In order to successfully do this it was vital that the students performed two tasks:

- Firstly they had to read the screen instructions carefully and record what each dragon liked best.
- Secondly it was vital to use pen and paper to write down each of the four dragons favourite food combination from a limited supply of 3 apples, 3 oranges, 3 lollies etc. because it was virtually impossible to do this from memory.

Very few of the children did either. As a result when they came to the dragon section the frequently became exasperated as the program kept sending them back to the beginning of the package and they had to commence the whole exercise again. But even when the program did this and they worked through the sections again up until the dragon section, they repeated the same mistake over and over again. As a result over time I became quite concerned about the quality of their interactions with the technology and the learning value and experience. Much of what I witnessed was mindless point and click activity, 'busywork' and 'game-playing'. For the most part the children were working away quite happily without any real understanding of what they were meant to be doing and without developing strategies for working through the software. This was compounded by the fact that this was the teacher's first experience of using the software and she herself did not know the package sufficiently to be able to advise the children on what they were meant to be doing. I think incidents such as these highlight the important role of the teacher even in a computerized environment and how teacher preparation, planning and knowledge

of the software is vital in order to ensure that the lab sessions are productive and conducive to learning.

I have no doubt but that the teacher involved was a highly conscientious teacher, after all I did preface all this by saying she was on a 'getting the hands dirty learning curve'. I am confident that if I returned to her class today that I would witness a different and much more productive scenario. As she told me in the interview which I conducted with her at the end of the year,

"Next year I think I will organize myself a bit better. I will try and integrate IT better with what's happening in other areas of the curriculum. I might link it better. Instead of saying this week and next week we're doing 'Granny's Garden' – I'll look for a better strategy than that."

It is clear from this statement that the teacher had learned a lot over the year and realized that she needed a different strategy to maximize the learning benefits for the students from their computer time. The point is she came to this understanding by throwing herself in at the deep end and by not being afraid to give it a go. My concern would lie with the many teachers out there who are unwilling through fear or a lack of confidence to take this first step, afraid to take the plunge because they are intimidated by the technology. Of even greater concern however would be the less conscientious teacher who might just go through the motions of taking children to the lab without being prepared to invest in the preparation time needed to get to know the software. There is a real danger as one principal from another school pointed out that computers in schools will follow in the footsteps of the TV and video and become a 'glorified babysitter.' If computers are to play a meaningful role in children's education strategies must be put in place to ensure that such dangers can be avoided, otherwise very little learning will take place. In this respect the information technology critic, Clifford Stoll, sounded a cautionary note when he described "computers in the classroom as the filmstrips of the 1990's". In an interview with the New York Times in 1996, when speaking of his own school days encounter with technology in the classroom he had this to say: *"We loved it because we didn't have to think for an hour, teachers loved it because they didn't have to teach, and parents loved it because it showed their school was high-tech."*

But no learning happened” (Oppenheimer 1997). It is imperative therefore that teachers become much more vigilant about and attentive to how children are using their computer time.

The “point and click, don’t stop to think phenomenon” was not just confined to the younger 3rd class students. I witnessed similar aberrations with the 6th class students, using a program called ‘Space Table Aliens’ for maths reinforcement. In the case of one 6th class, their teacher was one of the two teachers in the school who had reservations about computers and who was introduced to me initially as ‘one of our computer skeptics’. Despite her reservations she occasionally brought her class to the computer room where she was quite happy to let the children ‘just get on with it’. Her motivations in bringing them to the lab seemed to be prompted both by a desire to try out the new computer facilities and by a desire not to disappoint the students who wanted to have their computer time. To avoid going to the lab herself while at the same time not depriving the children of their computer time, she frequently swapped classes with the other 6th class teacher who would take her lab session while she took over his class in the classroom.

The strategy of just letting the children get on with it was not very effective. As the children were older and the class was smaller, the lab was less noisy and the children were much more familiar with computer basics and getting themselves started without assistance from the teacher, which was just as well as the teacher herself was not sufficiently familiar with this procedure to assist them. She was even less familiar with the software they were using and consequently performed the role of supervisor rather than that of teacher/facilitator. She relied heavily on the brighter and more IT literate students to help out children who were having difficulties. Perhaps the following incidents from my observation notes and accompanying reflections illustrate the dangers inherent in this type of dependency and laissez-faire approach

“At this stage one of the boys in the class is now helping out some of the other pupils who are getting stuck in the package.

The teacher comes over to me. She clearly likes the package. “I think it’s very good”, she says, “because at this stage tables are boring for them - yet they need to go over them, particularly the weaker ones.”

One of the pupils calls out "I don't know what to do Miss".

A boy near her comes to the rescue – "You have to type in the answer" he says. The teacher reinforces this intervention and says "Patrick will show you what to do."

It's clear to me that the teacher is not very well versed in the package herself and she is quite content to let some of the brighter and more I.T. literate students help the others out. At one level I can appreciate that this is a practical solution to the difficulty of her trying to get around to each individual student experiencing difficulties - and the students when they are working at the PC want to move on to the next screen - they don't like being stuck - waiting in turn for the teacher to come to them (the click and move on generation) - but on the other hand I don't see Patrick's intervention as being particularly useful. By telling the student what to do - 'Type the answer' he's not exactly helping the other student to think through the process. This is not Patrick's fault. He's not a teacher - just another 11 year old student. But it raises some interesting questions around how one needs to organise learning lab sessions such as these in order to maximise learning strategies to ensure learning can take place.

As I walk around the room, and observe the children working, one girl says, "Oh this mine has got too close to the bottom of the sea" (When this happens and if their overall scores are too low - they have to start at the beginning of the game again). This happened to her - 6 times. Her problem was she had no strategy for working through the game. She didn't seem to realise that you don't shoot down the mines in a linear fashion - that you have to shoot down the ones with the higher numbers first to avoid the mines crashing to the bottom of the sea. She only got through on the 6th attempt by trial and error. They don't appear to be developing any strategies for working through the program and the teacher isn't using any lab time to help them develop strategies.

I observed another boy stuck at a particular section. While his manual dexterity skills were good, he too didn't understand that the reason he was getting stuck was that he didn't understand that the game required you to type in the answers."

Obnotes (2/2/00)

Another significant point worthy of mention relates to children's own misconception of a problem once they encountered difficulties. Invariably they viewed it as a machine or technical problem rather than any fault in their own understanding, thinking process or strategy. Observing the 3rd class working on 'Space Table Aliens' one day, I made the following notes:

"It was a short session today as the class finished at 12.15. As I observed the children using the package I noticed that a handful of children were experiencing difficulties getting beyond the first two exercises on the screen. They were getting a bit impatient and frustrated as the package kept sending them back to the beginning again. It seemed to me that they were missing the point of the opening exercises where they were required to score a minimum of 60 points out of a 100.

"There's something wrong with my machine, one said to me. It keeps sending me back to the start." I asked her if she knew why that might be happening.

"No", she replied.

"What score did you get", I asked her.

"I don't know" she said.

I think it's interesting that some of the children don't seem to know what they are being asked to do and even more importantly don't seem to read the feedback messages that the screen gives them. If something goes wrong, they seem to think it's a technical fault with the machine rather than a fault with their understanding, thinking process or strategy. "

Obnotes, School 6, 16/2/00

Perhaps one of the most telling moments in these observation sessions occurred one day when I inadvertently ended up in charge of one class for almost 30 minutes in the lab. Not being a stranger to the children and knowing what they had been working on 'Table Aliens' the previous week, I got them to continue on with this exercise. The following extracts from my diary illustrates what happened:

"As I wandered around the room to observe the children working with table aliens a number of children began to run into the same problem as last week - with the package sending them back to the beginning of the program once they had completed the initial two exercises. As I was the 'teacher' at the moment, the children in difficulties were coming over to me to help them out. At one point about 6 children came over to me all at once for help while I was helping out one child. I asked them to go back to their desks and that I would come round to them as soon as I could.

From my observations last week, I knew that the problem was that they were not getting high enough scores for the package to allow them to proceed. Not wanting to give the answer to the child I was assisting, I got her to start from the beginning again.

When the program starts off the first two screens explain that the goal of the package is to save the table aliens from destruction and that this can only be done by breaking the codes (basically tables) to rescue them. The 3rd screen then tells the child you have to score 60 out of 100 to break down the first barrier to rescuing the table aliens. When they click at this point, they have to play a table game and then another game and the total scores are then added. If they achieve a score of less than 60 they are sent back to the beginning again. So when the child clicked and before she began to do the tables on the first game, I asked her what the instructions were, what had the screen told her up to that point. She told me that the screen said that "there once was a race called the table aliens who were in trouble and needed to be rescued".

"Did it tell you anything else,?" I enquired.

"No miss," she said

Prompting her I said, "did it tell you anything about scores, and how many points you needed to get?"

She looked at me blankly. It dawned on me at this point, that these kids don't read. They don't read the instructions on the screen. They just point and click and assume they're going to get to where they need to go.

As I knew there were a number of children having the same problem, and I wasn't going to have time to get around to them all, I decided the best way was to focus everybody's attention on the problem, to see if we could solve it as a group.

Naturally it took a bit of time to get everybody's attention away from their screens and to focus on me the 'teacher', but having finally got their attention, I explained to the class that some people were having a problem because they package kept sending them back to the beginning everytime they answered questions and I was wondering if anyone could explain why.

At least 3 kids said - 'they need to go into set-up Miss and change the settings' (an interesting answer - in other words as far as they are concerned the problem is a technical one - the technical settings in the computer - not a fault of the user - in the way they use the program or interpret the instructions).

I explained that I didn't think this was the answer in this case. I prompted them - and asked them if it had anything to do with scores and the

instructions that the program gives around scores. I was greeted with 35 blank faces. I gave up then and decided I would have to explain it to them. So I did , I explained that the reason they were being sent back to the beginning was because they weren't achieving high enough scores - that in order to go beyond the first section they had to achieve a minimum score of 60 points and that they must read carefully all the messages on the screen before they begin every section."

Obnotes, School 6, 16/2/00

I think it is clear from these incidents that many children have difficulties paying attention to detail and not just following instructions but actually reading them when it comes to computer software. The lure and seduction of the technology is such that they tend to ignore content while concentrating on the more superficial aspects of the technology such as the bells and whistles and the experience of moving from screen to screen. Teachers need to be alert to this fact and spend more time developing children's skills and critical faculties in this area.

There are interesting similarities in some of what I observed and what Sherry Turkle, sociology professor at MIT who has studied young people using computers for more than twenty years, also observed in some of her work. In her book, "Life on the Screen – Identity in the Age of the Internet" (1995) she describes a worrying experience with the simulation package, 'SimLife'. She was stunned by the way one 13 year old boy "kept playing even when he has no idea what is driving events. For example when his sea urchins become extinct, I ask him why? His reply was:

"I don't know, it's just something that happens"

"Do you know how to find out why it happened"

"No", the boy replied

"Do you mind that you can't tell why?"

"No. I don't let things like that bother me. It's not what's important", the boy replied."

"Life on the Screen – Identity in the Age of the Internet" (p.69)

Turkle is concerned about the level of passivity that computerized software can induce and the growing tendency 'to take things at interface value', as children focus their attention on manipulating software instead of engaging with subject matter. So concerned is Turkle about these developments that she has publicly stated "the possibilities of using this thing poorly so outweigh the chance of using it well, it makes people like us, who are fundamentally optimistic about computers, very reticent"(Oppenheimer, 1997).

I thought the IT coordinator raised an interesting issue when I spoke to him in the aftermath of the incident that has transpired in the lab that morning and discussed my concerns about it and the fact that children don't appear to be reading instructions and were consequently running into trouble.

"You're absolutely right", he said, "you've hit the nail on the head. The problem is that kids don't read anymore. They just click aimlessly away. You might find it strange if I told you that our goal as a school over the next five years is not IT but Literacy. We're going to be focusing our energies on literacy for all students and not just the weak ones because we feel that the standard of literacy for pupils of all abilities is dropping."

Obnotes, (16/6/02)

This begs the question why are literacy standards falling in an affluent suburb where parents put a high value on education? Is too much traditional leisure time now taken up with technology related past-times such as computer games, not to mention that older technology, television, at the expense of reading? Many teachers in this school believe this to be the case. Obviously this is an area that requires further investigation and analysis. But even on an anecdotal basis I believe it warrants attention as it raises questions about the extent to which technology is potentially compromising some key aspects of young children's cognitive development.

On this subject the educational psychologist, Jane Healy (1990) has written a controversial and thought provoking book entitled "Endangered Minds: Why Our Children Don't Think ", drawing on numerous interviews with teachers throughout the United States and with many leading neuroscientists. Central to Healy's thesis is

that developments in neuroscience, although still quite a young discipline, are pointing to the power of environmental factors in physically altering the dimensions of growing brains, thereby shaping brain structure, and in turn, learning behaviour. This concept of 'neural plasticity' effectively means that the way children use their brains causes physical changes in them. The implications are that "what children do every day, the ways in which they think and respond to the world, what they learn and the stimuli to which they decide to pay attention – shapes their brain" (p.50). According to neuroscience research, sensual stimuli not only changes the way in which the brain is used (functional change) but it also causes physical alterations (structural change) in the brain's neural wiring systems.

Healy discusses the implications of these research findings in the context of the growing body of teacher concerns regarding changes in how children behave, think and act. By the late 1980's many teachers in the US were concerned about the reduced attention span and the decline in writing and oral language skills that children from even the 'best' neighbourhoods were exhibiting. Citing a host of environmental factors such as diet, toxicity in the atmosphere, the changing nature of reduced parental contact, and therefore conversation, particularly with young children, and the amount of time children now spend with television and technology, she asks if these 'environmental' changes could possibly be changing how the developing brain works and perhaps be putting at risk the development of key cognitive functions particularly in the area of language development, listening skills and verbal reasoning. Failure to develop these skills in accordance with the maturation of the human brain could jeopardize the development of higher order thinking skills on which today's high tech society and indeed much of our culture depends. As the poet William Wordsworth once so eloquently phrased it 'language is not the garment but the incarnation of our thoughts'. In this respect Healy (1990) sounds a cautionary note when she reminds us:

" Language shapes culture, language shapes thinking – and language shapes brains. The verbal bath in which a society soaks its children arranges their synapses and their intellects; it helps them learn to reason, reflect and respond to the world. The brain is ravenous for language stimulation in early childhood but becomes increasingly resistant to change when the zero hour of puberty arrives. Severe deprivation of language during early years guarantees lasting neural changes that

noticeably affect speech and understanding. More subtle forms of language deprivation do not show up in such dramatic ways, but may ultimately affect abilities to think abstractly, plan ahead and defer gratification, control attention, and perform higher-order analysis and problem solving – the very skills so much at issue in American schools today...(p. 86)

..... If we want growing brains to build the foundations for traditional academic excellence, we must confront the habits of our culture that are changing the quality and quantity of our children's conversations – both interpersonal and with the written word. Children immersed in what linguists term 'primitive' language should not be criticized for failing to acquire linguistic sophistication" (p. 86/87).

The concerns which some teachers in school six and in the Wired for Learning primary schools expressed in relation to declining literacy standards, reduced attention spans and the difficulties which many children now have when it comes to summarizing and synthesising material for the written word, are very similar to what Healy heard from U.S. teachers in the late 1980's. As Ireland usually lags international trends by about ten years, it seems that we may now be encountering similar problems. If this is the case, our education system faces serious challenges in the years ahead. From both a societal and pedagogic perspective one of the key questions to be addressed must be 'is technology part of the problem or part of the solution, or perhaps both? If both, we must figure out how to use it wisely and judiciously in our schools. A prudent society, as Healy reminds us "controls its own infatuation with 'progress' when planning for its young" (p. 345).

"Unproven technologies and changing modes of living may offer lively visions, but they can also be detrimental to the development of the young plastic brain....There is a point at which fundamental neural substrates for reasoning may be jeopardized for children who lack proper physical, intellectual or emotional nurturance. Childhood and the brain have their own imperatives. In development, missed opportunities may be difficult to recapture...(p.345)

Young brains that have been modeled around skills maladaptive for learning, who lack the basics of conversation, thought, imagination, empathy and reflection, who cannot ponder what they have learned, are poorly equipped to become managers of the human enterprise in any era" (p. 346).

While this may sound a bit like a 'health warning' for policymakers and education technologist enthusiasts, it highlights some serious, frequently neglected issues in educational technology discourse on which more public debate and a lot more research is needed, especially as technology becomes more prevalent in schools. As Einstein once cautioned, "concern for man himself and his fate must always form the chief interest of all technical endeavours, in order that the creations of our mind shall be a blessing and not a curse to mankind." (cited in Fresse, 1997, p. 31).

Chapter Seven

Analysis and Interpretation of Case Study Data

Introduction

This chapter deals with the analysis of the case studies conducted at the Wired for Learning schools and the Thin Client school. Chapters two, three, five and six which presented profiles of the schools studied and the innovative technology projects being implemented, provide the context for this analysis. The purpose of this chapter is to combine the data collected at each site from observations, meetings, documentation and in-depth interviews with local 'actors' into a composite whole in order to report the findings of the study based on the entire data collected.

Inevitably findings or outcomes which can be categorised as either positive or challenging, and most balanced research reveals a combination of both, are uncovered through a process of analysis which effectively refines the research data gathered in the field. Once analysis has been completed the challenge for the researcher then becomes a matter of interpretation as he/she seeks to report on the significance of the findings from a broader perspective or theoretical stance. Of course not all qualitative research references its outcomes in term of theoretical frameworks. Strauss and Corban (1990), identify three approaches to qualitative analysis ranging from a low level of interpretation and abstraction engaged in by the researcher to a high level of interpretation and abstraction required for theory building (cited in Maykut and Morehouse 1994). The mid point on this continuum approximates to the 'interpretive-descriptive' approach to qualitative analysis as described by Belenkey (1992), which acknowledges the role which both description and theory can help in informing interpretation. The analysis for this chapter has been conducted in accordance with this model.

While logic might dictate that the findings follow a clinical reporting pattern in which data from each of the six research questions is individually reported on and discussed, the analysis suggests otherwise. This can be attributed to both a discrepancy between what the researcher initially sought to investigate and what the emergent data unveiled, and to the process of analysis itself, which proceeded from an analysis of the particular to a more holistic understanding of the phenomenon under investigation revealing significant overlap and interconnectedness between each of the research questions. In my opinion the danger in reporting out on each question individually would inevitably have lead to fragmentation and a loss of richness in the interpretation.

This is not to suggest that the initial research questions were of little or no value. On the contrary they were extremely valuable in framing the initial research focus and in guiding the subsequent analytical framework. As Stake (1995) reminds us the function of research questions is to direct the looking and thinking of the researcher enough but not too much. In other words we should not become slaves to our research questions lest we become blind to the emic issues emerging from our data. *What is important is not predetermined by the researcher* (Maykut & Moorehouse, 1994, p. 46) because fundamentally in qualitative research, data is studied for what is meaningful to the participants in the study which inevitably leads to a broadening or narrowing of the focus of inquiry as the data unfolds. This *progressive focussing* requires the researcher to systematically reduce the breadth of his/her inquiry to give more concentrated attention to the emerging issues (Parlett & Hamilton, 1976). It is these issues which are the prime focus of this analysis.

The chapter is divided into three sections. In the first section the key findings are presented and reported on. The second section deals with the issues and challenges that the emergent data revealed, specifically in relation to the WFL project where most of the challenges and issues emerged. The third and final section attempts to interpret the findings from both sections in the light of well known theories in order to provide a more thorough and comprehensive analysis.

Section One

Key Findings

The research data clearly indicates that schools and their staff have benefited from their involvement in both the WFL and Thin Client projects. A number of key findings have emerged from the research which can be classified into the following categories

- **Training and Professional Development**
- **Infrastructure and Technical Support**
- **ICT Development**
- **Organisational Development/Impact**

Training and Professional Development

As already detailed in chapters five and six, participation in both projects brought new training opportunities for all staff particularly in the area of ICT training, and for key Wired for Learning personnel, additional training and professional development was provided in areas such as network administration and management, change management, WFL course development and site visits to the US. With the possible exception of school four, the majority of teachers in the WFL schools had little or no experience of using computers prior to the commencement of the project.

The situation in the Thin Client school was somewhat different as most teachers had received previous ICT training and were using technology, albeit in a limited way, to support their teaching. Despite this however, the evolving nature of technology and the schools new technology infrastructure, meant that additional intensive training was required in order for teachers to update their skills and to encourage good usage of the system. For both projects then teacher training was identified as key priority from the outset to ensure the projects' success.

The issue of training was addressed mainly by research question five. An analysis of teacher responses to the subset of training related questions clearly indicate that the priority given to training, which represented a huge investment, had yielded positive results. For example when asked to comment on how satisfied they were with the amount and quality of training they had received and how well prepared they felt they were to use technology, the majority of teachers responded favourably:

The training for teachers in general was very good. We had phase one and two which is the standard NCTE ones and they were good and teachers learned a lot. Then we did one WFL week long course that was excellent. That was a big help and the teachers felt quite comfortable with that.

IT coordinator, School 1

The training has been very good. Most of the teachers now have an above basic knowledge. They are no longer struggling to keep up with the children. This time last year we had people who hardly knew what a mouse was....they knew nothing....and they have gone from that to downloading GIF's from the net and sticking them into a home page. There is a huge amount of change, a huge amount of learning has gone on. The training was very good.

Teacher 4, School 4

"I did the training last summer and I did the 10 week training course during the school year. The training made a tremendous difference, the last course in particular because I actually started going home and using my own PC and applied it to my own personal use, and having the computer in the class as well over the year has made a huge difference to me because I have been using it on a daily basis....Definitely training has improved my confidence in using computers and since receiving training I use technology more..."

Teacher 2, School 6

In terms of training, it is also very clear from the WFL schools that there was a clear deviation from the pattern of once off, disjointed courses to on-going professional training supported by on-site mentoring and peer tutoring by more experienced IT members of staff. Specifically school personnel have commented positively on:

- The collaborative nature of training received which fostered an encouraging and motivating atmosphere that was deemed critically important by first time ICT users. *"There was a real sense of helping each other out and it was a really nice feeling of openness with the computer courses and that has actually encouraged us – for example four of us are now doing external computer courses such as the ECDL course after work which wouldn't have happened before."*
- The use of teacher release time which supported their ongoing professional development both in terms of Wired for Learning and professional collegiality. *"It was good because you tend to come into school and do your work and don't really consult too often and get feedback from other teachers on how they would approach different subjects.... So it was interesting to see other people's approaches and how they would teach a lesson."*
- The opportunity to avail of training as a whole staff group. *"The thing I liked about the IT training is that the whole staff were doing it. When you do other courses you are the only one from your school and it's hard to bring back the full sense of the course to the staff, so you feel you have done this in isolation. Whereas with these courses, I've found them more useful because other people were in on them and it's spread out more among the school."*
- The tireless on-site support and helping hand provided by the IT co-ordinators, especially for older members of staff for whom the learning curve was very steep. *"We were very fortunate having our IT coordinator, she was brilliant. She helped me out at lunch hours, so it's important having people on the staff who are more computer literate than yourself."*

As the thin client school had had a longer involvement with ICT, a track record of training as a staff and a history of working collaboratively, many of the above benefits were not singled out for mention by interviewees but they were nonetheless present in the school. Of more significance from a training perspective in this case, was the way in which the culmination of past training, combined with current training and the improved technology infrastructure, was acting as a spring-board to catapult the integration of ICT into the teaching routine of most teachers, at a level which the school had not experienced before.

"I have done about 4 or 5 courses over the last couple of years and the training has definitely improved my confidence particularly in the last year now that we have all the computers. Up to this you did the course but you never had the chance to really follow it up because we didn't have enough computers and software. But now I can actually go and use what's there I feel much better about it. Since last summer's course I can now take the class in the lab and I can work with it. I am no longer saying to myself "gosh what am I going to do for this hour?" I actually feel now that I know what I can do, provided I do my homework myself beforehand. That's the important bit, doing my own homework.

Teacher 1

"People are now proficient and confident enough to go down to the computer room and I put it down to the fact that IT is now seen as non threatening and as being a fairly integral teaching tool. So absolutely the level of IT proficiency has risen....If somebody asked me about the SIP project or about the introduction of computers into schools I would make two fundamental points and one would be train the teachers, train the teachers, train the teachers. I can't repeat it often enough. You have to train the teachers and debunk the mystique".

Principal

In the WFL project while the general teaching body expressed satisfaction with both the amount and quality of training received, the IT co-ordinators were more critical of the specialised courses targeted at them, particularly when it came to the timeliness of the delivery. For example although the Network Management course was highly praised by the IT coordinators, there was a general feeling that it came too late and should have been delivered much earlier in the training roadmap. This criticism was understandable, given that it was not delivered until May 2000, just as the school holidays were looming and almost a year after the equipment had been installed. One coordinator also expressed a need for more in-depth training on the WFL product for the IT coordinators themselves, above and beyond what the main teaching staff had received:

"The project management courses, the network management courses and the change management courses all came at the wrong end. Maybe you have to be in the thing to get the full value out of some of these courses, but it's a bit late when the person is sitting down at the table to give them a

cookery course. They need to have the basics done before that. It would have helped certainly if these courses had been done earlier”

Assistant IT coordinator, school 4

“The network and systems training was super but it should have come a lot earlier because we really needed it earlier.”

IT coordinator, School 2

Although the timeliness of these courses negatively impacted key project personnel in the early stages of the project lifecycle, the WFL coordinators fared better than the thin client coordinator when it came to mission critical courses. He received no formal training at all in thin client technology and had to resort to the learn by doing approach to training.

“I found the learning curve very steep for Windows NT terminal server and I’m still finding it steep. Probably what is needed now that I’ve a years experience under my belt is a good training course where I would be able to grill the person who is giving the course to give me the answers that I require to the questions that I need answered at this stage. So it is a steep learning curve.”

IT coordinator, school 6

There were mixed feelings about the Change Management Training, delivered as part of the WFL project only, with four out of the five coordinators questioning its relevance to schools. Their reservations and concerns are probably best summed up in the words of one coordinator who said *“I didn’t find the Change Management Course useful. The presenter was very good and it was very well organised but as a classroom teacher, it was not suitable to a school”*. By way of contrast however, one coordinator felt that all school personnel could benefit from such a course:

“The Management of Change course should be given to all teachers. Now maybe they are not open to it but we are living in a hugely changing time and I think people could manage better if they realised that these strategies were in place (for dealing with change)”.

IT coordinator, School 4.

Principals were more positive about the benefits of change management training. One principal commented that she found the Change Management Workshop delivered by Professor Rosabeth Kanter *"very useful in reassuring you that you're going in the right direction and confirming a lot of things that you're trying to do."* Another principal said: *"It was a great help and although it was coming from the business perspective, none the less there was a lot of material there that would be useful to anyone in the sphere of management"*.

It is reasonable to conclude that by virtue of their position and responsibility for staff development that principals had a heightened sense of the importance of change management issues for the introduction of new programmes and projects such as WFL. The IT coordinators however appeared to be more role-bound and had a much narrower grasp of the change implications associated with the introduction of such programmes. Consequently they were unable to fully identify with and appreciate the value of the general principles of change management, which the programme fundamentally sought to communicate. In hindsight it is clear that if the course had included illustrations of successful change management models as applied to schools as opposed to business, it would have helped them to understand the relevance of change management and appreciate more fully their own role in this wider context.

The final words on the overall benefit of training and professional development opportunities which the projects brought to the school is probably best summarised by the teacher themselves. As one teacher succinctly phrased it: *"The best thing about this project is the professional development of teachers and our IT literacy has been enhanced and improved. The training we got was excellent and it actually encouraged us to work together."* Similar comments were echoed elsewhere:

"The best thing has been the change and the learning. Change in the way we do our work, and seeing the kids use the computers...I would not have worked with teachers in groups like this before, working together and really helping each other out, you know just working together as adults, that part of it has been very good. Just the whole learning experience I suppose".

IT coordinator, school 1.

Infrastructure and Technical Support

Participation in both projects meant a significant state of the art infrastructure was installed in all six schools. Each school was equipped with a first class networked computer laboratory. In addition the three WFL primary schools also distributed some of the project PC's into individual classrooms so that they ended up with computers in all classrooms when existing school computers were taken into account. A thin client device was also installed in each classroom as part of the thin client project.

The issue of infrastructure and technical support was addressed mainly by research question three with some overlap with research question one. In the course of the research, many interviewees referred to the equipment and infrastructure as being one of the best things about the WFL project. The huge investment in equipment and infrastructure provided the schools with a platform to exercise ICT exploration and integration in education on a scale, which heretofore was unrealisable. From the perspective of one IT coordinator, this donation of hardware equated to "ten years of fundraising for free." Other interviewees commented:

"The infrastructure it has given the school is fantastic, it is an absolutely marvellous facility, that has been wonderful because it would have taken us so long to get this far and what it has done is that it has allowed us to focus our grant on software because we didn't have to buy hardware. That's been great because we would have been able to build up a fairly good software resource by now".

IT coordinator, School 2

I already had a computer room here before we started, but without the project we would not have been able to upgrade to this level. There's no question that I wouldn't see this as a big benefit"

IT coordinator, School 5

"I couldn't but be pleased with the amount of hardware and software that has come here. We couldn't possibly have aspired to that on our own".

Principal, School 1

One of the significant benefits of this investment is that the WFL venture has been deemed by interviewees, as having bolstered and extended schools' efforts to ensure equality of educational opportunity for children, particularly for children located in a disadvantaged area like site one, by providing the potential for meaningful ICT exposure. As one IT coordinator commented, *"The project has made us a very technologically up to date school and it has given children who are in a disadvantaged area, advantages which they badly need"*. In a similar vein a principal from a neighbouring school said, *"Given our situation, our disadvantaged background, I wanted the school to progress in IT for the children's sake so I was thrilled to be receiving so many computers into the school. We have given a lot but we have gained a lot as well"*.

As part of the infrastructure commitment, IBM also provided extensive technical support for the schools for the duration of the project. The level of software support was rated highly by all IT coordinators. Hardware support however was viewed in a more problematic light and during the first year of the project this created a lot of frustration. The main problems encountered were (1) the time delay in getting hardware problems sorted, (2) lack of clarity on who was responsible for what and (3) the constant turnover of IBM hardware personnel which meant that from time to time, the IT coordinators found themselves dealing with engineers who had little or no knowledge of the project and how schools operate. These problems negatively impacted the project by creating tensions between IBM and some of the IT coordinators and school principals. This led to a certain amount of disillusionment with IBM and a resentment about how schools perceived they were being treated by the corporate body, which was probably best summed up by one of the IT coordinators:

"I'm grateful for the IBM/NCTE input. If I have to be critical I was expecting IBM's much vaunted project methodology to be more in evidence. Now maybe it might have been my own naivete but I would have thought that they would have brought the full power of their corporate skills in organising it. In terms of support for getting things up and running, I felt that IBM staff would leave fast without finishing tasks that they had to do. I understand that they were taken out of other projects and had to go back. I understand that professional IT people are at a premium. But I thought they would have at least said, "We're not leaving this place until we've got everything right," but no, they would get things half

working right and say they would have to come back on the rest. So obviously their window of opportunity for the education sector is obviously small. So I'd have to be critical in that area...

....IBM technical personnel tended to change as well, the technical staff would change very quickly and when I was talking to other schools, they found the same. They said we would have liked to establish a rapport with the technical people coming in and all of a sudden you find they are being pulled off somewhere else. Now again that may be life but it was a detrimental factor as far as we were concerned."

IT coordinator

To put this statement in context, it was made by one of the most technically proficient coordinators in the WFL project, located at the second site. One would have expected that many of these issues would have been sorted out by the time the second site had come on stream. But apparently this was not the case. It is therefore easy to understand the frustration levels of key project personnel with certain aspects of the project, particularly at site one, where two of the three coordinators had little or no exposure to IT prior to their involvement with WFL. It is reasonable therefore to conclude that for them the issue of timely and prompt support and the comfort factor of dealing with someone familiar with the project was of critical importance. In hindsight this probably should have been given more attention and a higher priority in the project-planning phase.

By way of contrast, the thin client project did not experience such difficulties. Of course this project was much more self-contained as it involved only one school, one IT coordinator with outstanding technical ability and little or no involvement from outside bodies. Even though Microsoft made a significant investment in the project, it was not instrumental in the project's conception or development in the way that IBM was with WFL and in effect acted more like a 'sleeping partner' with no further involvement with the project once it donated the money. In this sense its contribution was more representative of traditional corporate philanthropy as opposed to IBM's which had a more strategic orientation as already discussed in chapter two.

Probably one of the most striking feature of the thin client project from the infrastructure perspective was the extent to which teachers felt that this system was far superior to what they had experienced in the school up to this point both in terms of the number of machines and the reliability of the system. As a result of the reliability of the system teachers became more confident about using technology in their teaching and a lot more comfortable about taking their classes to the lab. Furthermore the numbers of machines in the lab which virtually resulted in a 1:1 ratio for most classes simplified class organisational and management issues for the teachers and therefore encouraged greater usage. Even one of the 'computer sceptical' teachers commented on the superiority of the new system compared to what had been available before.

"In the lab I have experienced very few technical problems that couldn't be resolved. In the last year since we got the new equipment, there has been a big improvement. Before that it was hassle. There was always breakdowns, always something going off screens, problems with monitors and computers. I suppose I'd be better able to tackle that now. It's ideal at the moment as I only have a class of 21, so everyone has their own machine".

Teacher 3, School 6

"I haven't experienced any technical problems in the lab. Initially in September I was intimidated by the technology, afraid to put my foot in the door, because I was afraid I would break things. When I brought the kids down the IT coordinator said 'right, we'll start off with such a programme' and I couldn't believe that there were no problems. Many of the kids were totally familiar with all this. I would know how to bring them down and get them going on to the first steps and then it runs itself. So that kind of settled me, but initially I thought I would never use them".

Computer sceptic, School 6

"I find the computer lab very useful. I used the old lab on a regular basis but the new one has taken off to a much greater extent. The maintenance is much easier although it has its own teething problems.

Teacher 10, School 6

The reliability of the thin client infrastructure was also positively commented on by the IT coordinator who had this to say:

"I have absolutely no hardware maintenance after 12 months on 40 machines, not a penny spent on maintenance, not a minute wasted. I think if you were an administrator in an average school with a 40 PC network, you would have to visit each machine on and off throughout the year to make sure they were working fine. Whereas basically with the NC's if you reset them they come back onto the network perfectly".

The one technical problem consistently referred to by all interviewees and which was a persistent feature of many of the lab observation sessions that I conducted, was the 'time-out' error problem as a result of system overload from multimedia rich programmes. Interestingly, although this problem was extremely frustrating for teachers it didn't deter them from using the lab. It was as if they had reached a stage where they were determined to use the facilities irrespective of this problem. Furthermore once the IT coordinator had worked out a fix for the problem, albeit a less than ideal one, they were happy to continue using the lab facility, despite the inconvenience. In so doing they were able to put a sense of perspective on the nature of the problem and could see that the benefits overall outweighed this irritating problem. This is evidence of a growing maturity among them in relation to technology, a realisation that technical glitches are an inevitable part of any new system and a growing confidence in their own ability to teach in a technologically mediated environment without feeling defeated by the technology even when technical problems arose. The lesson seems clear – you have to go around the block a few times – to reach this critical stage.

ICT Development

An analysis of the data from research questions 2, 3, 5 and to a lesser extent, question 1, reveals that the projects have accelerated the process of ICT development for both teachers and pupils in the participating schools. This can be attributed to a combination of the amount of hardware, which the projects brought to the school and participation in the project itself which required everyone to get 'stuck in' and

actually use IT media generally and Wired for Learning software specifically. The reported benefits are:

- Improved Teacher Confidence and Competence in ICT.
- Teacher Professional Development in ICT viewed as a high priority.
- Acceleration of the process of ICT integration.
- An improved learning environment for students

Improved Teacher Confidence and Competence in ICT

In the Wired for Learning schools most teachers reported that participation in the Wired for Learning project had accelerated their IT skill development and that they now felt more confident and competent in using IT. A number also expressed the view that they have developed from novice users to the point where they can use the medium in support of children's learning.

"Before we started WFL I wasn't very computer literate and I was very slow. I'm more computer literate now. I can e-mail, I can search the net and also my typing is improving".

Teacher 10, School 4

"Before WFL my technology skills were woeful. Now I think they're wonderful. I'm more confident. I brought my class to the computer room and I was very confident once I began".

Teacher 2, School 3

"I find the computer in the classroom makes the lessons more challenging. It improves the children's computer skills and their language skill when they're writing essays. When they go onto the computer, it will tell them their spelling mistake and they often accept a correction better from the computer than from a teacher. Because the computer highlights the word, they have to say well where did I go wrong and what are the other possibilities. I find that works very well because I can score them for their creativity while the computer scores them for their spellings. So that's nice".

Teacher 3, School 1

Similarly teachers from the thin client project felt that their IT literacy and competency skills had improved while at the same time acknowledging that there was still room for improvement:

"On a scale of 1 – 5 my computer literacy at the beginning of the year would have been 1.5. I would now rate myself at a 3. My computer competency now would be a 3-4.

Teacher 2

"I used computers quite a lot this year – a certain amount for English and quite a lot in History.... On a scale of 1-5, I might be around a 2 or 2.5 at this stage in terms of my confidence when using computers. I still have a long way to go. I would love to get to the stage where I didn't need the IT coordinator's help when [technical] problems arise. But hopefully that will come with practice."

Teacher 1

"Yes, no doubt my technology skills have improved over the year. Before I had to think about sending emails but now I just do it."

Teacher 6

Acceleration of the process of ICT integration

Across all schools, the projects have provided a robust technology platform, which has accelerated the process of ICT integration. This is particularly evident in both schools one and two, which of all the participating schools, had minimal exposure to ICT prior to their involvement with WFL. In the words of one of the teachers *"We would be way further back if this project hadn't arrived on our lap. It has brought us on tremendously right slap into the technology age, some of us a bit more reluctantly than others."*

Similar comments were expressed in other schools which to varying degrees had a level of ICT exposure prior to their involvement with WFL.

"We have come on in leaps since this project. We were doing quite well as it was with our computer room beforehand, but we are far more familiar and at ease with computers now. We are now in the 21st century and we have to leave the chalk and the blackboard behind and move into the

computer age. That's the age the children are at and we have to move with them. Certainly WFL has helped us move faster than lots of other country school or city schools. They wouldn't be as advanced as us"

Teacher 3, School 4

"I am definitely using computers more now than I ever did before and finding them very useful – even just putting material on floppy disk. You can re-use the information year by year, different handouts that you make, revision exercises etc."

Teacher 3, School 3

"Before I went on career break we only had two computers here in the school. I was shocked when I came back to find out how advanced they had become. It's great thought to feel that you are part of something new. I think it's great for what we are doing, the planning of lessons on the computer. Getting to know about attachments and scanning and all that is just brilliant. It makes you look for more things to do, for new ideas, new approaches, it's great having all that technology at your fingertips."

Teacher 4, School 2

"The benefits are immense and spilling over beyond Wired for Learning. Teachers are now using the web and other software for their daily work. So the project has helped IT integration even though there was some resistance to it at the beginning. But it's becoming the acceptable way to do things now."

IT coordinator, School 5

"I was never much in favour of a computer class. It has to be a support tool to what you are doing. I use an integrated approach to my teaching anyway. I would take a whole topic and incorporate a particular computer program into that. So I would use it to enhance something that I had been teaching in class, using the computer as a tool".

Teacher 7, School 6

"I don't think IT should be seen as a subject in itself. We don't go down to the lab to do computers, we go down to look at history or nature or [maths] tables and it just happens to be on a computer rather than on a blackboard."

Teacher 6, School 6

The general level of satisfaction which the interviewees expressed with their ICT skill development and its concomitant acceleration of the ICT integration process is encouraging. I should caution however that I am using the term 'ICT integration' very liberally, to take account of the very low IT base that some of the WFL schools were starting from. Therefore when I speak of 'ICT integration' I am interpreting it in relative rather than absolute terms. It is clear from an individual analysis of each of the six schools that there is a huge variation in the level of ICT integration across all schools, with both school 4 and school 6 displaying a higher level of integration from a pedagogic perspective when assessed in absolute terms. This can be largely attributed to the fact that both schools had a higher level of teacher engagement with ICT prior to the commencement of the respective projects.

Teacher Professional Development in ICT viewed as a high priority

Because of the project and the support given to it both internally within the schools by the IT coordinators and most schools principals, and in the case of the WFL project, externally by the NCTE and IBM, teachers have a heightened sense of the importance of technology skills acquisition. When asked if teacher professional development in IT was a high priority in the school, teachers invariably answered that it had a very high priority, ranking it on average at a **7 or 8 on a scale of 1 to 10**. One teacher commented, *"We have given it a high priority and that's been driven by the fact that the WFL project was here. If that hadn't been there we might not have even started to think about it that much"*. In another school a teacher said: *"Since we got WFL it has become a priority. Before this we were getting along nicely at a slower pace and definitely WFL has upped the pace"*. Similarly one of the teachers from the thin client project responded: *"It is a priority in this school. Technology has been all the drive in the last couple of years. If you look at the amount of money the school has spent on computers in the last five years, it's more than what has been spent on any other area over the last twenty years. So we have prioritised technology."*

Impact on Students

Wired for Learning's primary objective is to empower school change for the betterment of childrens' education. In the WFL schools teachers in general have commented positively on both the ICT advancement of their students and the motivating effects on overall learning, particularly for very disadvantaged children, by virtue of the school's participation in WFL.

"I think they are never too young to start using computers. I find that the children love word processing; they are able to see their work. They are all now quite familiar with the tools of WP i.e. the space bar and the page up and down keys. They are learning particular skills like sentence construction when they are using the computer and they use the skills then in other areas."

Teacher 9, school 4

" I just find it's a huge focus point for children who have learning difficulties, they just love the visuals, the graphics, the whole idea of doing computer work. It's a huge break from just the traditional teaching. It's a completely new departure for me and for them and I find it very exciting."

Teacher 2, school 2

"It's a boost for them to see their own work on the screen and it coming up correctly and that in turn motivates them to try again, to try harder if there is a more difficult task set for them. They can see – o.k. I have been able to manage one task so why shouldn't I go onto the next level. It's not like writing in a copybook where they make a mess of something and it disgusts them. Here they can chop and change and arrange... so it's a confidence builder as well."

Teacher 5, school 1

It is interesting to note that the reported benefits, particularly in the primary schools, are not directly attributable to the WFL software per se but rather to the fact that the children are using the hardware provided by the project to access educational software that is supportive of the school curriculum. Interviews with teachers suggest that children's progress is directly attributable to the sizeable infrastructure and availability of hardware that has given pupils wide access to education software, which is supportive of the curriculum being taught in their classes and schools. These

interviews also indicate that the younger the child the less likely he/she is to be exposed to the WFL software. This created a certain amount of tension in the project as teachers generally were more interested in having a learning software package that could be used directly with children in the classroom rather than a software system designed primarily for use as a communications tool and lesson planning package for teachers.

Although improved ICT skills, increased student motivation and benefits for disadvantaged students was cited at most schools, an analysis of the data from both school four and school six reveals a much richer set of responses in terms of student impact. Teachers in these schools were more inclined to offer concrete examples of how the technology was actually being used to support and enhance the student learning environment and how they were integrating IT into their teaching routine. They also displayed greater critical awareness of some of the 'pitfalls' associated with technology in the classroom than teachers in other schools. This was particularly noticeable in school six. Here again a track record of involvement with ICT and a school policy mandate requiring all teachers to teach during scheduled lab classes in both schools helps to explain this difference.

"We have an hour and a half in the lab once a week. It reinforces what we are actually doing in the classroom because we are doing counting in the classroom and we are doing counting on the computers. We are doing initial sounds from the alphabet in the classroom and we are actually doing it on the computer. So it actually reinforces what they are learning in the classroom and because it's a different medium, it makes the whole thing more concrete in their minds".

Teachers 7 & 8, School 4

"The benefits are, let's take a child with learning difficulties, straight away you have constant drill and practice be it English or Maths. So you have very good software online and on CD-ROM available for those children and the good thing is whereas I would get frustrated, the computer never will. Then when you go to the middle group of students it improves their confidence. It's the fact that they have another tool that they can use and they can show and publish their work better and present a talk. So they have a resource at their fingertips with the computer. Computers are very good in the class because they can take you to places you could never dream of. "
(IT coordinator, School 4)

"I would think of computers as being an aid and I know it's something the children enjoy. It's much easier this year now that the children can go down to the lab and each work on their own machine. Normally if they write a poem we can correct it and if they write a story they can print it out and make a copy for themselves and the class and add in pictures. So that's good. They have also done a millennium project on themselves and their families and they really got a lot out of that. They did fabulous work scanning and they helped each other out as well which has been good. They have used it as well for various subjects and for reasoning. My best in the class has been challenged...."

It's very interesting in class when they have gone past the stage of running in in the morning and playing games. I know another class beside them and they play games every morning. Mine will ask if they have free time if they can go and type out some stuff or check something on the internet. They have gone past looking up wrestling...But you need to keep an eye on things."

Teacher 9, School 6

"Software can be presented as fantastic, and really when you look at it ,it's not. We need to evaluate software more to see what's good and what 's not. It needs to be evaluated not just at school level but at the top level too by the Department of Education.

My concerns about the use of computers relate to the overuse of them or the incorrect use of them. Just letting the children go down to the computer room with no follow-up and no checking what the children are doing. I would be just afraid that that's what it would become and that would be just time wasted. My biggest concern would be that the children aren't learning any new skill because they have their computers at home and they are coming into school and doing the same thing. One child in my class in particular, he is so obsessed with the computer that I have to seat him where he can't see the computers... "

Teacher 7, school 6

Organisation Development/Impact

At an organisational level, both projects have impacted many aspects of school organisational life to varying degrees across participating schools. This is particularly evident in the WFL schools where both the nature and complexity of the project combined with its sheer scale had a dramatic effect on organisational processes and structures, not all of which were welcome nor viewed positively across the board.

Because the thin-client project was so technically focussed, its effects from an organisational perspective were less pervasive. Nonetheless the project was deemed to have had a positive effect on some aspects of organisational life by the school principal and an analysis of interview data reveals subtle influences on aspects of staff development and school management.

The organisational impact of the projects on schools was addressed through research questions 1, 4 and 6. Data from the research interviews reveal that the project had impacted organisational development in the following areas:

- School morale
- Management
- Collaboration and Communications

School Morale

Because of their involvement in the projects, staff and students were exposed to unique opportunities, resulting in a positive effect on the image of the school and the morale of the whole school community. School five hosted a visit by personnel from the Department of Education in Luxembourg who met with students, teachers and parents using WFL. Similarly school six hosted numerous visits from education departments internationally. Staff from school three hosted an information evening

on the Wired for Learning project for other schools in the county to discuss their experience of the project. One teacher commented *"I remember feeling very proud when we had our open night for the other schools. I remember sitting down and saying to myself, did we really do all that, and I was so proud of it and the fact that we came together as volunteers and did all that. It bonded us as a staff and we felt we were making progress"*.

This 'feel-good' factor and spirit of camaraderie was also expressed elsewhere:

"From the pupils point of view it has certainly generated excitement. It has lifted their morale" and has created a sense of ownership – a sense of we've got something extra and I think that has all kinds of spin-offs. It has also motivated teachers and opened up new horizons for us"

Principal, School 1

"One of the best things about the project has been the collaboration, the collegiality, the feeling of we're working together on a new project. I think you can't quantify that, that's just something that carries through a school and helps a staff to develop and out of that you can then more easily take on more issues, policy issues in the school because you have got into the mode of working together, you've got used to sharing stuff."

Teacher 2, School 2

"The prestige of being involved in a project like this is good for the school and our staff are shining out as well. It has brought the staff together and brought skills out in staff that I didn't know they had. So it's making us more of a team, put it that way."

IT coordinator, School 3

"The project has been a great benefit from a PR point of view and for parental perception. We had the official opening and the minister came and that generated a whole lot of enthusiasm. It has been of great benefit to the teachers because it has debunked the myth that you have to be a whiz kid to operate computers and it's been of tremendous benefit to the children....It has given everybody a sense of pride in the school, and an ownership of it....."

Principal, School 6

Management

There have been a number of management benefits and spin-offs from WFL. In one school, School Development Planning has been conducted using WFL's Teacher's Lounge and Conferencing facilities. This has enhanced staff meetings by encouraging greater participation in and reflection on important issues by staff members beyond the physical time constraints of the normal school meeting. In another school, WFL has transformed how the principal manages and organises the day to day running of the school:

"From an administration point of view I find it fantastic. I use it practically every day for the Teacher's Lounge and for daily notices. It's A-One for communicating with teachers and with the board of management. I find the calendar of events is excellent and it's great for filling out DES forms as well. It's all there at the click of a button. It has helped my filing system considerably."

Principal, School 3

Another important development is that in some cases, WFL has necessitated the delegation of responsibility in the schools for the project by virtue of its size and scale. As a result school committees have been set up with teacher representatives from different grades and disciplines to implement different aspects of the project. These committees have begun to examine issues of central importance to the success of WFL including curriculum integration, school development planning, whole school evaluation and policy formation.

Undoubtedly these developments have had a positive impact in terms of strengthening teachers' professional development and repertoire and broadening the middle management base in schools. In line with recent DES measures to support the phased introduction of a middle management tier in Irish schools over recent years, these are encouraging developments.

Collaboration and Communications

Most teachers reported that participation in WFL had given them the opportunity to collaborate more with each other. Teachers reported how training opportunities to learn the software as a group, in addition to the use of teacher release time which gave them the opportunity to plan how to use the system and to input lessons and resources into WFL, all helped this process. As one teacher phrased it – *“the project has given us a chance to work together as adults”*.

The facility afforded by the system to create a repository of resources for each year group was cited as a particularly welcome feature of the system and evidence of greater transparency, co-operation and collaboration among staff members. In most schools the project was deemed to be encouraging more collaboration between teachers and helping to create a more open and sharing culture. Schools which already had a tradition of sharing saw WFL as extending and enhancing their activities in this regard.

“I’d say it has helped to create a culture of openness and sharing, because teachers tend to very individualistic, everybody tends to work on their own but with this there has been a lot of sharing of resources and also with the training, people have helped each other out. There has been a great spirit of assisting all those who might not be as quick off the mark. It’s been very good in that respect.”

Teacher 1, School 1

“Sharing – that’s one of the big things with the project for pooling resources etc. Before this we all had our own selection of books, videos, magazines and even though they were bought for the department, nobody knew where they were or who had them if were they accessible. That is now being put on the WFL, so we know what’s there. With WFL we have met four times extra in the year to discuss WFL issues and that worked. So it brought us together as a group more often than if it wasn’t in existence.”

Teacher, 2, School 3

Despite these encouraging comments it is important to draw a distinction between the collaboration that was obviously occurring at a project level and teacher’s utilisation of the collaborative potential of the WFL software, which was really slow to take off

across all schools, particularly when it came to lesson planning. Although there were many objections around lesson planning which I will discuss in greater detail in the next section, one of the fundamental objections appeared to revolve around a reluctance on the part of teachers to share their lesson plans with each other. So when one digs deep into the data analysis, contradictory evidence suggests a 'disconnect' between what people were saying was happening and what was actually going on in people's heads. It's not that people weren't telling the truth. It's more that they were interpreting collaboration and sharing at a superficial level, rather than at a deeper and more fundamental level concerning their own professional practices. For this reason one would have to question the project's ability to sustain the benefit of an improved collaborative culture over the long term at the organisational level.

A similar dichotomy exists in relation to communications, where on the one hand there was evidence of good communications throughout the schools as result of project involvement, yet on the other hand, the potential of the projects' communication tools were not being utilised. In the course of the interviews most teachers expressed a preference for personal communications with each other and with students above electronic communications for day to day matters and were very reluctant to engage with electronic communications with parents. In this context it's very encouraging to see how the actions of two principals to address this problem was yielding positive results.

In school one for example, the decision of the school principal to use the WFL platform as a vehicle for staff development and policy development encouraged the staff there to engage with this new form of communication for school related matters at a policy and strategic level. The IT coordinator reported how the use of the system for encouraging staff members to electronically communicate agenda items for staff meetings via Teachers Lounge had increased teacher involvement with and contributions to the proceedings. Similarly the principal commented:

"We made big use of WFL coming up to the school development planning day where the various items were put up and people could comment and add to it and the thing then evolved which meant that it wasn't necessary to have continuous meetings which you couldn't have anyway. So in that sense it gives a change for ongoing communications".

Principal, School 1

Similarly school 3, reported significant progress in using WFL for ongoing, day-to-day communications within the school, due largely to the influence of the principal and vice-principal who role modelled the medium, with attendant efficiency benefits:

"It's working very well from an administrative side. I'll give you an example. One day I was on the corridor and the principal said I left a message for you on WFL, did you contact the parent in question? No, I said I hadn't, so from then on I knew the onus was on me to check had the principal sent me any messages. So it's great from their point of view that as soon as a phone call comes in, it can be entered into private conferencing, so that is working very well. It is putting the onus on you to check your messages and it makes it far easier to get messages... It has improved communications big time and it has helped to bond the staff as well."

Teacher 2, School 3.

"I communicate with my principal more often now through Teacher's Lounge rather than verbally because it's easier and she always replies very quickly. Both the principal and vice principal input everything into the events calendar, it's full, it's chocker block which shows great commitment to the project."

Teacher 4, School 3

In examining this whole area of collaboration and communications it's useful to look at the experience of the school six. Unlike the WFL project where one of the key objectives was to promote collaboration and communications in schools by providing an electronic platform to facilitate this process, the thin client project had no such objective. Nonetheless, here too teachers reported that the project enhanced the school's existing collaborative culture but even more revealing was the fact that none of the contradictory evidence around collaboration and sharing surfaced. Instead of people talking about teachers 'hoarding' books and ideas and being reluctant to share

and use each other's lesson plans, teachers here spoke about 'flinging books across the corridor to each other,' openly sharing ideas , and planning their work together in year groups as part of their normal teaching practice. There appeared to be a seamless integration between the collaborative opportunities afforded by technology and the normal modus operandi of the existing culture where the sharing of lesson plans and good professional practice were the norm.

"The project has increased collaboration in the school because anything we know we had to get to know together. If you thought someone knew half a step better than you, you would say how do you do that...It has facilitated the sharing of resources because if I'm in the lab and I find some program that I think is ideal for some topic in my class I would pass on that information."

Teacher 6, School 6

"I'll give you just one particular experience when I had 4th class I did a computer oriented project on Vikings and it included art work. Then when this years 4th class teacher was doing Vikings we were chatting about it and I told her this resource was there, material that we had prepared and she used it and was delighted with it. So it certainly can promote collaboration but if you haven't got people who can get on in the first place it won't overcome that."

Teacher 8, School 6.

There can be no doubt that the implementation of both projects required people to work together more closely than normal and therefore encouraged more collaboration and more communication. In most cases this enhanced the 'feel good factor' in the schools. There can also be no doubt but that the WFL project has the potential to create a new model of collaboration and communications for schools **provided** teachers can take the project experience of working together and turn it into a permanent professional norm and engage with the system's electronic and collaborative tools. Failure to do so will result in a diminution of the project's communication and collaborative potential once the project support structures are removed. Should this happen , and the jury is still out on this one, a rich source of organisational learning and development would be lost.

Section Two

Issues and Challenges

Introduction

While it is clear that schools have received major benefits from participation in Wired for Learning and that the process of integrating WFL into the school environment is now underway in most schools, it is also clear that a project as pioneering and ambitious as WFL involved a steep learning curve which experientially was both painful and stressful for many participants. Inevitably issues of dissonance, disappointment and frustration arose in the course of the project and still linger in some quarters. This is understandable as teachers were required not only to come to terms with an intricate technology tool which tested their fledgling IT skills to the limit, but also, and indeed more fundamentally, an instrument of transformation that confronted their professional practices. Consequently a number of issues and difficulties arose from which key learning experiences have emerged, in the following areas:

- **Project Implementation**
- **Structural Support**
- **The School and Teaching Culture**

Project Implementation

Given the scale and complexity of the WFL project it is inevitable that a number of implementation issues and difficulties emerged. Some of these issues appeared to have been more pronounced at the first site than at the second site which is an inevitable outcome of being the first 'test' site in any pioneering project. Nonetheless many of these 'teething' problems had an unsettling affect on the schools and

appeared to have hindered the rate at which they progressed. A combination of factors contributed to the challenges that emerged during implementation, and which were experienced to varying and lesser degrees across the participating schools. The most significant of these were:

- Project announcement and Start-up Issues
- Project Management and the Tripartite Project Structure
- Project Ownership and Commitment

Project Announcement and Start-up

Before schools could be selected for inclusion in the project, IBM and DES had first to formally sign a Letter of Agreement. Although IBM had worked extremely hard at a corporate and local level to have the agreement signed sealed and delivered by the end of February, 1988, the signing was delayed by DES for several months. This delay can be attributed to several factors including concerns about setting a precedent in committing to such a high level 'matching' funding and charting new territory by embarking on such a high profile form of private-public partnership. Furthermore as funding was controlled by the Department of Finance, this complicated the issue by adding an additional party to the negotiations (Kanter, 1999).

In addition there was also a problem concerning the Statement of Work. It was normal practice at government level to have a detailed statement of work in place before committing funding to a project. However this went against the whole philosophy of the Reinventing Education program where the Statement of Work involved IBM working in partnership with schools and teachers over a series of several months to work out the specific needs of the individual site. So straight away there was a classic 'catch 22' dilemma. IBM, quite rightly, couldn't produce a Statement of Work without (a) having identified schools for project participation and (b) working with those schools to determine their needs. Equally the civil servants were afraid to commit public funds to a project without a cross on every 't' and a dot on every 'i'. Eventually an Irish solution to an Irish problem was found. A

compromise agreement was brokered whereby a 'Letter of Understanding' was developed stating explicitly that a 'Statement of Work' would be the first task to be tackled after the signing of the Agreement.

As a result of these procrastinations, the formal agreement was not signed off by both parties until June 1998 and as Louis Gerstner the CEO of IBM was scheduled to visit Ireland in August 1988, IBM wanted to use this occasion to announce the project and the participating schools to the media. But at this stage the schools were closed for the summer holidays and teachers were not due to return until September. This meant that in the site one schools, principals did not have the opportunity to discuss the project with their staff or parents prior to committing to the project. Because they didn't have this opportunity the knock-on effects were two fold as people either:

- (a) resented the fact that they heard about their school's involvement with the project through the national media without prior consultation about what was involved and what they had been 'signed-up' for!
- (b) returned to school in September full of excitement about the project and expecting to see computers dangling from chandeliers!

The fact that computers didn't actually arrive in the schools till the following April, when the bulk of the school year was almost over, exacerbated an already difficult situation for the project leaders as they tried to maintain teacher enthusiasm for the project and keep staff on board. As one coordinator explained:

"It was like trying to play football with no ball. People could not see the relevance of the project because they had not got their hands on the equipment and software and although there were an awful lot of planning meetings during this time about the project, these meetings did not make a lot of sense to teachers because there was nothing concrete for them to see."

Meeting Notes (May 22, 1999)

One coordinator in particular felt that the delay in getting the equipment and software installed compromised her own professional standing among fellow members of staff and severely dented her credibility. All coordinators in the site one schools were of the opinion that the project was harmed by the poor timing of the announcement and the subsequent delay in getting the equipment and software installed. These hic-ups also tarnished the reputation of IBM in the eyes of many teachers who were suspicious enough about their motives for being involved with schools in the first place. These problems only added grist to the mill.

In fairness to IBM neither problem was of their own making, as in both instances their original project plans were stymied by bureaucratic procedures which they hadn't anticipated. The delay in installing the equipment occurred because DES feared that EU anti-competition laws could be breached if so many schools were equipped with IBM computers. As DES was funding the project and therefore the machines on a 50:50 basis with IBM, it was decided to put the equipment supply portion of the project out to tender. Hence the delay. As it turned out IBM was awarded the machine supply contract, printers excepted, as a result of the tendering process. But in this situation it wasn't a case of 'all's well that ends well' as the delays caused untold damage at a very delicate stage of the project's development.

These events made the task of galvanising teacher support for the project much more challenging for the site one principals by comparison with their site two counterparts, who did not become involved in the project until March 1999. Therefore they had ample time to discuss the project and its implications with teachers and parents before committing to the project and publicly announcing their involvement. As the machine tendering issue had already been sorted at this stage, they received their equipment within weeks of signing up for the project.

It seems clear that it would have been better to have postponed the public announcement of the project for the site one schools until after all the stakeholders had been informed about and consulted on the project. This would have made for a

smoother ride during the project start up phase for the project champions in the schools i.e. the principals and IT coordinators.

Another area of concern, which was particularly troublesome for the two site one schools with little or no IT experience, related to the perceived lack of urgency in getting technical problems resolved in a timely manner, as has already been discussed in the previous section. This coupled with delays in getting an Irish version of the Wired for Learning software also caused difficulties.

"In the beginning I wasn't happy with the level of support from IBM but it did improve over time and as IBM pointed out, they were only learning and they were muddling around in the dark as well. But we expected them to know what they were doing and they didn't really tell us that they didn't know what they were doing. So there was a lot of initial disappointment and I suppose that is inevitable because we were the first pilot project... but there was a loss of faith there for a while and that was difficult because it was perceived as not being very well run and the software was not great"

IT Coordinator A, site 1

It is probably true to say that the researcher arrived at the school at a point where all of these issues had reached culmination point. Consequently as a result of the primacy of these issues in the experience of the participants, the research stance of the researcher had to adjust to take cognizance of these issues, and acknowledge the extent to which they had a significant influence on participants' perceptions about the project and impacted the implementation process.

Project Management and the Tripartite Project Structure

The tripartite project structure appears to have complicated the management of the project from the perspective of IT coordinators and some principals and created confusion. Many expressed a dissatisfaction about the lack of clarity in the relationship between DES, the NCTE and IBM which meant that they were often

unclear about whom to contact in connection with different issues at different stages of the project.

"I felt the relationship between the NCTE, IBM and ourselves wasn't made very clear.. It was fragmented and then the Department of Education was involved as well, so you had three bodies involved in supplying the resources and doing the tendering so they seemed to be circling around each other in that way. If IBM were doing it on their own maybe they would have done it differently."

IT coordinator, Site 2

This fragmentation coupled with a perception that project management was not as pristine in practice as it appeared on paper created a certain amount of tension and disquiet in some quarters.

"I think I would have preferred to have had more things settled, more things signed sealed and sorted about all those technical things before we began. I know it was a learning situation for everybody involved but one felt that one got information in drips and drabs. It was all a little bit back to front. A feeling of working in the dark, you know...when are we going to be told this, when are we going to find out about that.. There were difficult times like that but that is part of a project I suppose."

Principal B, Site 1

"I've gone along to meetings and there are deadlines set and there are things to be delivered and my impression is that when the next meeting is coming up – for a week or so beforehand all hell breaks loose as they try to meet the deadline. We all kind of tend to operate that way but I would have found myself prior to that saying to staff that "such and such a thing wouldn't be acceptable in industry or commerce. We are professionals, and if we say we'll do something, it should happen when it should". I was quite surprised with that aspect of it".

Principal A, Site 1

Project Ownership and Commitment

It is clear from the project documentation that both IBM and the NCTE made strenuous efforts particularly during the start-up phase to inform schools about WFL and what participation would entail. Nonetheless in the course of the research many participants said that they lacked a clear understanding of exactly what the WFL project would involve at both a school and teacher level and the extent of the commitment that would be required. A large part of this 'gap in understanding' can be attributed to the complexity of the Wired for Learning project itself which made it a very difficult project to explain and implement and more fundamentally to the manner in which schools were 'targeted' for participation in the project.

In the case of the site one schools they were chosen because of their proximity to the IBM technology campus and the fact that they were categorised as 'disadvantaged' by DES. Although the WFL project pre-empted the announcement of SIP by a couple of months, the history of ICT development particularly in schools one and two, suggests that they would not have been sufficiently IT advanced to apply for a SIP project of their own accord. The situation in site two was somewhat different. In this case you had one school, school four, as outlined in chapter 5, which had legitimately made a conscious decision not to apply for a SIP project but who were subsequently 'persuaded' to join 'WFL' on a principle of expediency rather than any real desire on the part of the school to participate. By comparison, school three actually applied for a SIP project and from there they were offered the WFL project, which closely dovetailed their original SIP proposal and had the added benefits of a significant infrastructure investment. Effectively what this meant was that here you had a major national project representing a huge public and private sector investment involving five schools of which only one could be said to be a willing and enthusiastic participant. It is hardly surprising therefore that it is this school which has made the most progress in terms of integrating WFL into the school environment, where the project has met the least amount of resistance and where there is a clear sense of ownership across different strata of the school. 'School Readiness' therefore must be viewed as a key variable in terms of school selection when it comes to the implementation of innovative projects and subsequent project success.

There were many repercussions from the 'targeted' school selection procedure. It meant that schools did not 'buy-in' to the WFL vision and initially saw their participation in terms of one thing only, namely the acquisition of hardware. In many ways they had a blinkered view of the nature of their participation and did not fully understand the quid pro quo reciprocity that would be required of them in terms of testing out the Wired for Learning software. It took a long time for schools to grasp that this project wasn't simply about the donation of large amounts of hardware to schools but that it also involved a research and development dimension that would require them to test out the Wired for Learning software, localise it for an Irish context and experiment with it to their own advantage. Although teachers had been told that they would be involved in the process of localisation, they clearly did not fully comprehend what this would entail in terms of their own time commitment and shifting project timelines, which are an inevitable part of product roll-outs. The site two schools had a clearer understanding than the site one schools about the localisation commitment.

"Our overall impression was that we assumed we were testing the software and developing a body of work that may be used by other teachers. The first thing I asked when IBM came to visit us is 'are we beta testing the software?' And they said 'no, you're essentially relocating the software and adapting it to the European system and changing out the Americanisms – that's what you're doing' So they presented their case very well in fairness."

IT coordinator, Site 2

It is clear that the site one schools did not share this understanding and that they expected a polished, finished product when the software arrived, which it clearly was not. This led to disappointments and frustrations as they tried to use the software in an Irish context and discovered that it didn't quite fit the system here. Then there was the added complication of different versions and releases of the software to address localisation issues and the technical migration from the Lotus Notes 4.6 platform to the Notes 5 platform, none of which happened in tandem. Inevitably bugs occurred which made the system unstable and subject to crashes. This was a disaster as teachers lost vital material that they had spent hours inputting and in some cases

experienced disruption at the classroom level when they tried to use the software with students. Privately one IT coordinator commented “my staff weren’t interested in all these versions that IBM was on about, all they were interested in was a version that worked”. Another coordinator said:

“The project would have been easier to implement if they had waited a bit longer until they had the software all ironed out. It would have started from a better basis and instilled more confidence in people if they could go in and do their work without having a whole load of things happen that they didn’t expect to happen. I mean it’s easy to put off people who are just beginning to use technology”

Because most schools did not buy into the WFL vision it prevented them from developing a sense of ownership for the project, making it their own and integrating it more fully within the school system. As a result there developed a tendency among schools to see Wired for Learning as the ‘IBM Project’ and to ask IBM and the NCTE “what do you want us to do”?

“The teachers felt they had to produce and produce, but was it for IBM or the NCTE, they didn’t know why they were producing it. We know now that it was really for ourselves. Maybe I should have been more open with IBM and NCTE and told them of the difficulties that I was having. But then hindsight is a great teacher.”

Principal, Site 2

If the schools don’t develop a sense of ownership for the project during the project implementation phase, it is likely that this project will remain simply another project that will become vulnerable to the effects of staff turnover and changing priorities within the schools. Only time will tell if this issue can be resolved but the early signs are ominous.

Structural Support

International research on change, school reform and the introduction of IT (Fullan, 1991; The Rand Studies, 1974 – 1978; Hall & Hord, 1987; McInerney, 1989; Pelgrum and Plomp, 1993; SeirTec, 1998; CCT 1999; OECD 2001) points to the crucial role of leadership in implementing and supporting innovative projects and

technology implementation. By definition leadership refers to both leadership at the school level i.e. the principal and/or a shared leadership model spearheaded by the principal, and leadership at the 'system' level by the administration that supports schools and to whom schools are answerable. Both successful change and successful school based IT projects depend on the proper structural support systems being in place, the key ones being:

- A committed and supportive school principal
- A pro-active and visionary administration
- A robust, sustainable and well resourced technical support system

It is not surprising therefore that in the course of this research issues surfaced in relation to each of these areas, which ultimately need to be addressed if the project's goals and ambitions are to be fully realised.

The key role of the Principal

As an initiator or implementer of change the principal plays a crucial role (Sarason 1996). In most schools it is the principal who can influence and shape the organisational environment for success. The principal is the 'gatekeeper of change' (Berman and McLaughlin, 1975). Implementing change at the school level requires unique skills for even the most talented principal as he or she must deal with the psychological and sociological ramifications of change and its emotional impact on teachers as well as on the school as a system (Fullan 1991). Of crucial importance therefore is the manner in which principals have been trained for leadership roles and their ability to execute and manage change. Unfortunately as Sarason (1996) points out, most principals by virtue of previous experience, formal training and the process of selection are not prepared for the requirements of leadership and the inevitable conflicts and problems that beset a leader, particularly when change is required. It should come as no surprise therefore that nearly all principals in the Wired for Learning schools felt ill equipped to deal with the change ramifications of the project for the school system and struggled to give effective guidance to their staff. At each and every school principals reported that they had not been trained by the system that employed them to perform the role of change leader:

"The pat answer is I haven't been prepared for that role, but then to be fair has any principal been prepared for it. The truth of the matter is like most principals I got the job because I was perceived to be a good class teacher.

Principal, Site 1

"I feel I needed more help in order to get change going. I'd like to see more support from the Department because you're kind of left on your own a bit. ... It was difficult for me as a principal trying to integrate the staff, trying to get up to speed myself personally I felt a bit thrown by it. I found it hard to come to terms with."

Principal, Site 2

Despite these obstacles however most principals in the WFL schools in conjunction with their IT coordinators took on the mantle of project champions and promoted the project to the best of their abilities. Naturally some were more effective than others either because they had a vision about what they were trying to achieve or because they went that extra mile to ensure that the project was well supported. It is interesting to note that the WFL school which to date has achieved the most success in terms of project implementation and galvanising staff support for it, is the school where the principal has a clear vision of where the project fits in terms of whole school development, and who is also an exemplary role model in terms of using the WFL software. This is in keeping with international research findings, (McInerny 1989; Pelgrum, 1993; OECD 2001) which show that as principals role model computer use, others are in turn motivated to apply the computer to their academic work or at least become more aware of ICT's potential. The leader who expects to see technology used in the classroom but does not know how to use e-mails sends, at best a mixed message (Seir-Tec, 1998). Similarly the OECD report on "Learning to Change: ICT in Schools" (2001) reminds us:

Increasingly, principals are using technology in the administrative side of school management and in communications with education authorities, While this in itself will not lead pedagogical change, it has its own values and can add to a general organisational awareness of ICT's potential. Innovations in curriculum practice and administration advancing together may be mutually supportive (OECD 2001, P. 90).

In the Wired for Learning project the schools that have struggled most with the project and where a high level of staff resistance has emerged are those schools where the principal has had a spurious engagement with the project or has adopted a hands off approach. So here again principal support must be regarded as a key variable in project implementation and success. Both the attitude and the behaviour of the principal are clearly noted by staff and have a significant influence on how staff think, behave and react. In this respect it is interesting to note the different observations made by teachers about the supporting role of the Principal.

"Our school management and principal tend to be very hands off. They leave things run, so it will find it's own level. They don't push or drive things. Whether that is a completely good thing or not is debatable, maybe it needs an extra push or maybe the people who coordinate it would need an extra bit of support from management or the principal because the coordinators are not in a position of authority in the school."

Teacher 4, School 4

"The Principal's support is very good. The Principal is always there and always helping out and the principal uses WFL a lot as well. All notices go up on the calendar and they are printed off from WFL so I think the support from both the principal and vice principal for it is very good. They are very positive about it."

Teacher,3 School 3

"The Principal has given me free reign to manage the project as I see best. The steering committee have been doing their best to promote the project and integrate it within the curriculum."

IT coordinator, School 5

"I was very happy with the level of support from the school principal because I'd say if I had worked in a school where the principal wasn't that interested or felt that I should just work away and do my best and that it would all come right in the end, it wouldn't have worked. But our principal was always very actively engaged in the project and that was a big help. It nearly wouldn't have survived without that."

IT coordinator, School 1

Although the leadership role played by the principal is vital, the task of implementing innovative technology projects can prove less onerous and even more effective where a shared leadership model is adapted. Research conducted by CCT (1999) on the integration of technology in Chicago Public Schools showed that the schools which seemed to be most effective in combining “infrastructure development, teacher training, and classroom integration of technology were those that had, at a minimum, a principal and technology coordinator working together as a team to identify needs, seek out resources, and implement programs”. Similarly findings from the Seir-Tec (1998) project reveal that when a ‘shared leadership’ model is deployed, school technology committees can serve an important leadership role. As Kearsley and Lynch (1992) argue “leadership does not only come from individuals. Committees, development groups, subject-centered teams, and associations, may all play leadership roles” (p.3). The ability to leverage the distributed nature of leadership expertise (Spillane et al., 1999) in an organisation plays a key role in any school reform effort.

Applying the principle of shared leadership to both the WFL project and the Thin Client project yields some interesting insights. In the Thin Client project the principal and the IT coordinator had a very close working relationship and their complementary skills drove the school’s ICT development and plans. When they embarked on the SIP project they also leveraged the expertise of others in the school and outside the school i.e. knowledgeable IT parents to form the project steering committee. Thus there were elements of both shared and distributed forms of leadership although the shared ‘principal/coordinator’ leadership model predominated. Likewise in WFL school three, the principal and vice principal worked very closely together in driving the project forward and appointed two IT coordinators, one to look after the infrastructure and another to take care of project development. Furthermore teacher committees in different subject areas were formed to ‘pilot’ different aspects of the WFL software. Here the leadership model deployed was both shared and widely distributed. Significantly both these schools encountered minimal staff resistance to their respective projects and where resistance occurred they appeared to be able to contain it, thereby neutralising its effects on organisational morale. While the distributed leadership concept clearly adds an extra

dimension to leadership effectiveness, particularly when a complex innovation like ICT is involved, the leadership role of the principal is still a principle factor in this model.

Role of the Department and the Inspectorate

Change rarely happens without an advocate or champion. Fullan (1982) suggests that one of the most powerful change advocates is the superintendent or district administrator. Generally it is this person who sets the expectations and tone of the pattern of change within a school district. It is also this individual who can support or impede the implementation of innovative programs. Needless to say without “buy-in” from the larger and more powerful administration from which schools and teachers take their cue, little innovation will occur.

“Regardless of the source of change, the single most important factor is how central office administrators take to change.the attitudes and behavior of the district administrators are crucial. If they take it seriously, the change stands a chance of being implemented. If they do not, it has little chance of going beyond the odd classroom or school.” (p. 165)

It is clear from what people said both directly and confidentially in the course of this research that teachers, principals and key members of the Project Core Team felt that DES had not really played the part which they expected them to play in supporting this innovation. For many this was a source of disappointment as they had high expectations based on the project structure, project definition document and statement of work that the inspectorate would play a prominent role in guiding and directing the initiative. The schools and the Project Core Team expected that the inspectors would be more integrally involved with the project because as part of the partnership agreement it was agreed that the inspectors would be released for the equivalent of half their time to work on the project as Project Directors.

As part of their tasks the Project Directors were required to conduct regular site meetings which could be convened by them and them only. In the first year of the project’s implementation (1999/2000), only one such meeting was ever convened for site two and thereafter no further meetings ever took place. Site one fared a little

better in that their inspector convened a number of meetings during year one but by year two (2000/2001) they became increasingly infrequent and eventually non-existent. The situation was further aggravated by the fact that one of the key members of the Project Core Team resigned during year two and it took several months to appoint a replacement. This meant that the Site Committees which should have played a key role in the overall development of the project never really took off and as a consequence the whole project structure was weakened. Furthermore the absence of involvement by the inspectors, was acutely felt by the primary schools where traditionally the inspectorate has had a far more influential role over what happens in schools, than is the case in the secondary sector. This created a situation where people felt unsupported and undervalued which in turn led to a certain amount of disillusionment:

"I think one of the worst things about the project was the feeling of not being valued and I don't mean it in just a monetary sense. If you were doing all this extra work in a business your contribution would be recognised. It's just that you're not seen as having made any contribution in the real sense by those higher up who pay our salaries, who organise our promotions. It counts for nothing."

Assistant IT coordinator

"I feel that the Department has let us down in that they haven't changed at all. Yet they are expecting us to change to this new commitment, to a new technology, to many new ways of thinking and yet they are giving us very little in return."

Teacher

"From the Department we got a nodding of support. Initially an inspector supported it but he has been involved in providing resource teachers for other initiatives so he hasn't really come back to us. I would like more support from the Department. If they could provide someone, not even necessarily an inspector, to help us along with it."

Principal

These sentiments and their repercussions for the project development are supported by international research findings. McLaughlin and Marsh (1978) in their work on staff development and change found that :

"The attitudes of district administrators about a planned change effort were a 'signal' to teachers as to how seriously they should take a special project. The fieldwork offers numerous examples of teachers - many of whom supported project goals - who decided not to put in the necessary extra effort simply because they did not feel the district administrators were interested". (p. 72)

It is very difficult to explain precisely why the Project Directors did not engage with the project in the manner that had been expected of them, not least because they were not interviewed as part of the research process and therefore their perspective on what was going on has not been voiced. Interviews were not conducted on the basis that the researcher was advised from reliable sources that they would be unlikely to be granted if requested. Given that by year two the Project Directors were keeping themselves at arms length from other members of the Project Core Team and keeping even them in the dark, I think that advice was well founded. This then is one of those situations when tacit understanding rather than explicit knowledge needs to be drawn on in order to provide some rational explanation.

I think a combination of both 'local' and 'political' factors shed some light on what happened. Very early on in the project's implementation phase it became quite clear that the site one schools experienced a lot of teacher resistance and opposition to the project. In one school in particular teachers were questioning the extent to which their trade unions had been made aware of the implications of this project in terms of how it was changing teacher normal work practices and similar undertones of potential trade union implications existed elsewhere, although less overtly expressed. Undoubtedly theses rumbling undertones were fed back into DES by its project representatives i.e the Project Directors and it is likely that a decision was made to distance itself and by implication its Project Directors from the project.

Furthermore by the time WFL moved into implementation phase a new Minister for Education and Science had been appointed. Thus the original Minister who had been responsible for the 'Schools IT 2000' initiative and who had enthusiastically embraced WFL and was keen to see it implemented, was no longer in charge. Inevitably new ministerial appointments mean shifting priorities in the civil service administration and it was widely believed by teachers on the ground that ICT in schools and the entire 'Schools IT 2000' initiative was not a high priority on the new Minister's agenda. If this was the case, and I believe history will attest to the veracity of this perception, then it is hardly surprising that WFL was 'jettisoned' by department officials before it had ever really got off the starting blocks.

Looked at in this context there are interesting comparisons to be drawn between what happened at a 'political' level in Ireland with WFL specifically and 'Schools IT 2000' generally and, with government initiated international reform projects elsewhere. Examining the role of the federal government in the failure of the "Experimental Schools" [ES] project in the U.S in the early 1970's, Kirst (1982) argues:

"In a short period the Washington political context for ES had turned from an idea with high level support and enthusiasm to a small program buried in a new agency that wanted to reorient or eliminate it. ES was destined to be another marginal program that came and went in the shifting sands of Washington politics". (p. 280)

I think if you replace the words 'new agency' with the phrase 'new administration', you come pretty close to explaining what really happened to WFL in terms of DES support. Undoubtedly these political developments influenced the performance of the Project Directors in their relationships with the schools.

One must also ask to what extent the original decision to endorse the WFL project by DES was prompted by 'opportunistic' motives. Citing the work of Pincus (1974) and Berman and McLaughlin (1977), Fullan (1991), reminds us that the adoption decisions of school districts can be characterised as either 'opportunistic (bureaucratic)' or 'problem -solving'. Opportunistic decisions which are usually prompted by the availability of external funding frequently result in very little

change occurring as there is a weak commitment to project objectives and goals across the board from district administrators to classroom teachers. Whereas problem solving decisions which emerge in response to locally identified needs usually generate a strong commitment to projects resulting in lasting change. This then begs the question, did DES endorse the project because of the amount of funding IBM was contributing, in the same way that some of the participating schools endorsed it because of the equipment they would receive, without any real deep understanding of the quid quo pro reciprocity that would be required of them in terms of a commitment to change?

Sustainability and Ongoing Technical Support

As a result of the project, there has been a significant investment in computer equipment and network facilities in all schools. The IT coordinators and their assistants have invested huge amounts of personal time not just in terms of supporting the project but also in maintaining the computer networks, albeit with the support of IBM and NCTE. Question marks have to be raised about the long-term sustainability of this huge voluntary effort and the provision of technical support once the project support structures provided by IBM and NCTE are withdrawn. It is clear that the ongoing day-to-day problem of computer maintenance need to be addressed. In one school the IT coordinator is managing up to 100 PC's and a server supporting three schools, in addition to teaching for up to 12 hours a week and providing training to new staff. If this was a business or an industry, such a network would be managed by one if not two full-time technicians. The present position is unsatisfactory as it is unfair on the teachers themselves and it is leaving schools exposed because they are reliant on one or two individuals. The IT coordinators and principals are unhappy about this situation:

"The level of technical support available to teachers is not good enough. At the moment we are relying upon the voluntary efforts of enthusiastic teachers who somehow or other have picked up the skills. That whole area is going to have to be formally addressed.....There will always be enthusiastic teachers in schools, but it's a hap-hazard way around it, and it's a bit unfair."

IT coordinator, Site 2

"Teachers are teachers and that's the way they have been trained. They are not computer maintenance engineers – if they were they wouldn't be teaching. So I think it's very important to have a roving technician between the schools where there is a list of snags left out for that person, that they come and fix them and then go onto the next school – that is going to be crucial in my view."

IT coordinator, Site 1

The reality is that without the IT coordinator, very little would have happened. Now she didn't have a tremendous amount of IT skills to start with and she'd be the first to admit it. But she worked very hard at it. Her role was crucial not just in terms of her IT skills but also her management skills. The whole business of liaising with so many different teachers is a huge thing. And also her perspective about the educational aspect of computers was a huge asset. . Her role was absolutely crucial."

Principal, Site 1

"It would be good to get additional technical support, not to be expecting a full time teacher to do it because the IT administrator has been absolutely tremendous and without this person it would have been very difficult. We were just lucky our IT person was so interested, so committed and so generous."

Principal, Site 2

This level of dependency on the generosity of the IT coordinators is not unique to the WFL project. The Thin Client project also relies heavily on the good-will and unique talents of its IT coordinator to keep its ICT infrastructure well oiled and in good working order. In fact so great is the dependency here, that the principal sought a personal guarantee from the IT coordinator that he would not leave the school to avail of potentially more rewarding opportunities elsewhere as the "Schools IT 2000" initiative gathered momentum, before agreeing to support the SIP thin client project application. One wonders to what extent this personal guarantee has in fact become a morally binding obligation on the IT coordinator now that the thin client infrastructure has become embedded in the school. Even though the project is now over, would the IT coordinator feel free to leave to take on other challenges at a more strategic level? What would the consequences for the school be if he left? If the

principal was prepared to freely acknowledge that without the IT coordinator there would have been no SIP project, does this mean that the continued mainstreaming of the innovations long term benefits is also highly dependent on his involvement?. Personally in my opinion it does because even though the principal and IT coordinator had identified another member of staff to be trained as a technical back-up assistant, I think it would take a huge investment in training to bring this teacher up to the requisite level of technical expertise. And that would be the easy part. The real problem would be trying to transfer the IT coordinator's level of motivation, brand of enthusiasm and love of all things technical to another individual or group of individuals. Therein lies the ultimate challenge. Only time will tell if this can be achieved.

The School and Teaching Culture

Compared with many other sectors, education has been slow to make changes in organisational practice and culture through the adoption of ICT (OECD 2001). This can be largely attributed to the fact that there exists in schools deep-rooted structures, attitudes and values that have been characterised as the grammar of schools (Tyack and Cuban, 1995) which militate against any kind of innovation or change. Sarason (1990) suggests that the school culture must be taken into account when trying to gain a better understanding of the organisational context and when trying to comprehend the dynamics of school systems and how its multiple contexts impede the success or failure of innovative endeavours. As Cuban (1993b) reminds us "the cultures of teaching that have developed within the occupation tilt toward stability in classroom practices" (p.18). This means that teachers are fundamentally conservative, prefer stability and are sceptical when it comes to implementing or adopting change.

Schein (1993), probably one of the most influential organisational culture theorists defines culture as "a pattern of shared basic assumptions that a group has learned as it solved its problems of external adaptation and integration, that has worked well enough to be considered valid and therefore to be taught to new members as the correct way to perceive, think and feel in relation to those problems" (p. 12). The power of culture he argues comes from the fact that these assumptions are shared and

mutually reinforced. This makes change very difficult to achieve because many of these basic assumptions are implicit and so deep-rooted that they are neither confronted nor debated. When it comes to understanding change and the change process he argues that culture is a most useful concept because it helps us to better understand “the hidden and complex aspects of organisational life”.

A deep analysis of much of the data emanating from the research reveals some very powerful cultural belief and practices in operation in the schools that have impeded the progress of Wired for Learning’s assimilation into the school culture and value system. A number of teacher concerns which arose in the course of this research are intimately interwoven with deeply held cultural beliefs about the nature of schooling and teacher’s conceptions of their role. The most significant of these occurred in relation to the following:

- Lesson Planning
- Teacher Accountability
- Parental Involvement
- Business/Education partnerships

Lesson Planning

By and large, teachers were uncomfortable with the instructional planner section of WFL with its emphasis on lesson planning and sharing. Although there were some legitimate criticisms about this part of the software being too procedural, somewhat unwieldy and at times a bit cumbersome, fundamentally the nub of the problem appeared to be the fact that the instructional planner confronted the teachers professional practices in terms of how they planned, managed and organised their teaching. It also challenged their beliefs about what teachers fundamentally do and ought to do, in that they see teaching as a dynamic craft which requires a lot of on the spot creative input, whereas they felt that the instructional planner with its systematic and scientific approach to lesson planning could potentially undermine the craft of teaching, the teacher’s creativity and the dynamic of the classroom environment. Naturally this created a certain amount of dissonance and provided powerful insights into some deeply held basic assumptions. The most prominent of these were that:

- Teachers do not systematically or rigorously plan out their lessons because they instinctively know what they are going to teach. A frequent response was *"At this stage in my life, after x years teaching, I am not going to change to writing out lesson plans. I know in my head what I'm going to teach" or "lesson plans are such a personal thing that, their unique to each teacher, so you couldn't possibly share them with someone else"*
- Teachers don't have the time to do structured lesson plans: *"Time is the big problem when it comes to lesson plans. It's just not practical. If you had to put plans into the PC for every single day and every single class and you have 8 classes a day, it would take you a lifetime to do it."*
- A fear of peer criticism. *"There is a reluctance around lesson planning because teachers have a red biro mentality, you know we are always looking for the mistakes rather than the good points, even with our own work and because we are highly critical of ourselves it makes it very difficult for us to have others look critically at our work. We have problems with that."*
- A reluctance to share class notes and professional practices. Some teachers referred to the culture of 'hoarding' and an unwillingness to share good classroom practices with each other. A lot of this stems from the culture of schooling, which traditionally has encouraged competition between students, and which in the past has fostered a winner takes all attitude. In terms of teacher development this has created a vicious circle as teachers progressed from students in the classroom to teachers in the classroom with little or no exposure to the modern work place that values teamwork and professional co-operation among workers above competitive individualism. Consequently when a tool like WFL comes along which encourages and promotes professional co-operation, collaboration and communication, it challenges those basic assumptions that have shaped and influenced teacher attitudes and thinking. *"I've heard it said I'm not willing to do that – why should I put hours of work in for it to be shared out. That seems to be the attitude. I don't know what it would take to change that attitude. How do you change the way people think. A lot of the people are in the system and teaching a very long time. Maybe with newer and younger teachers it might change then"*.

When it comes to lesson planning, there is also a difference in the culture of the primary and post-primary sectors which becomes very apparent when a tool like WFL is introduced. Unlike primary teachers who are required to produce lesson plans regularly for inspection by departmental inspectors, for example “An Cuntas Miosúil” (monthly plan) and “An Scéim Bliana” (yearly plan), secondary teachers in the Irish education system have no such requirement. This meant that the instructional planner section of WFL seemed quite alien to how secondary teachers traditionally went about organising their approach to lesson planning. As one Principal commented:

“I feel that writing lesson plans isn’t part of the culture of secondary teaching in Ireland. Up until now you were king in your classroom. You did what you liked as long as you prepared people for exams and they got through. You could effectively keep anybody out of your classroom, you could even refuse an inspector. If lesson planning was part of the school plan like it is in England and America and in primary schools, then it would be easier because people would see it as part of their roles, whereas now they see it as an additional burden. I think that’s where the difficulty lies”.

It has long been acknowledged that teaching can be quite an isolated profession and that the nature of teaching means that teachers do not have the same opportunities for interacting with their peers as is the norm in most other adult occupations. As a result sharing class notes and professional practices with each other is not part of the teaching culture and traditionally teachers don’t operate in this way. Consequently when a tool like WFL comes along, which encourages and promotes professional cooperation, collaboration and communication, it creates a certain amount of dissonance because it challenges many deeply held beliefs about what teachers do and how the school and teaching culture operates. In an ironic way this is a positive development as it has created debate and discussion in some schools about issues which are rarely discussed and aired in the open. By offering a different and more inclusive model of working, Wired for Learning has the potential to encourage teacher reflection on the traditional school culture and its modus operandi which over time could prove extremely beneficial.

Parental Involvement

Parental involvement is another cultural norm that the WFL project has confronted and around which debate has emerged in the schools. While hotly debated this aspect of the project has been slow to take off. In some cases this can be partly attributed to technical problems that prevented communications happening and to low home computer ownership among parents, which is estimated to be only about 18% in site one. This only tells part of the story however. Deep-rooted cultural beliefs about the nature of teacher-parent contact tell the other part.

Teachers have expressed many concerns about engaging in new forms of electronic communication with parents. The time issue is one factor. Teachers are wondering where will they get the time to respond to parent emails, if it will make them busier and mean that they will have to work after school hours to service parental e-mails. In addition concerns abound in relation to accountability and vulnerability. One teacher said, *"It's dead easy to say private conference with a parent, but you need to protect the teacher"*. Another teacher said *"You can't just land something like this on a staff and expect them to accept it without putting a protection policy in place"*.

In addition in schools where parents have been trained specifically on the Wired for Learning software in order to encourage online communications, teachers appear to have cultural reservations about private conferencing with parents. Some teachers feel it's a bit 'American', something which is suited to large city schools in large urban areas like New York and Boston where teachers and parents rarely meet, but not to small schools in close-knit communities in semi-urban areas, where there is a lot of informal contact with parents at local and community events. Many teachers have expressed the view that parents don't appear to be engaging in private conferencing with them and therefore have concluded that they are not interested. But that may not be the only way of looking at it. There appears to be a contradiction between this lack of engagement by parents in this new form of communication and teacher concerns about being inundated by e-mails and not having the time to service them.

The reality is that teachers traditionally have had minimal contact with parents, particularly once children leave the junior cycle, and there is no reason to suggest that electronic communications of itself is going to change that pattern. The advantage of electronic conferencing is that it facilitates communication between teachers and parents in a more convenient way than traditional methods, on those occasions when teachers need to contact parents directly and vice versa. In this respect it is worth referring to the US experience with WFL, where teachers too feared that private conferencing would lead to volumes of parental emails, and have been quite surprised that this has turned out not to be the case. For US teachers using WFL, the convenience of this method of communication has turned out to be the real winner and teachers there would be very reluctant now to return to more traditional methods.

It can also be argued that schools need to look at private conferencing from a broader perspective than they have to date. The real potential of WFL needs to be understood in the context of the changing nature of teacher-parent contact in a more transparent and open society as it is here that WFL has most to offer. Instead of thinking about teacher-parent communications just in terms teacher-parent contact around childrens' learning and classroom behaviour, schools need to give more thought to how they can leverage the power of WFL to involve parents more in decision making about policies and other issues that affect the running of the school. DES has already mandated that schools need to have parental involvement in all major policy decisions. Wired for Learning is an ideal vehicle for encouraging this type of involvement. Clearly WFL can facilitate this development, but the real problem in my opinion is that it requires a departure in mind-set about parental involvement which potentially threatens traditional power relationships in the school. Understood in these terms the real question therefore becomes - do teachers want parents involved with schools in this way and to what extent does a tool like WFL threaten traditional teacher autonomy by making it easier for parents to have a more active involvement in the school's daily life and modus operandi? Is that why some schools are clamouring for 'teacher protection' while others have simply not attempted to provide parental training on WFL and have not involved their HSCL staff in WFL training?

The problem of change as Sarason (1996) reminds us is the problem of power as ultimately power suffuses all relationships in the culture of the school. When this culture is threatened by change agents or change projects, the basis of power relationships which are normally submerged in cultural subconsciousness, rise to the fore when "someone" decides that something will be changed and "others" are then required to implement that change. He goes on to argue:

"If others have no say in the decision. If there was no forum or allotted time for others to express their ideas or feelings, if others comes to feel they are not respected, if they feel their professionalism has been demeaned, the stage is set for change to fail". (p. 335)

Clearly the question of parental involvement and private conferencing is a thorny one that has raised issues about cultural norms and practices and teacher/parent power relationship which need to be more formally addressed at a strategic and policy level. Teachers, justifiably, have expressed the need for clear guidelines from DES about the direction for electronic communications. It is clear that many of their concerns need to be addressed and protocols established if this aspect of the project is to take root, develop and mature.

Accountability

From Lesson Planning to communicating with peers, parents and principals online, teachers are concerned that WFL is making them more accountable. There is a deep suspicion in some quarters that the introduction WFL is an attempt to bring in greater teacher accountability through the back door. Some teachers were extremely defensive around this issue, arguing that the public examination system is the norm through which their professional accountability is maintained, and by which they are judged, and they wanted to keep it that way. There was a reluctance to accept a widening of the concept of accountability to include other areas of their professional life in areas such as lesson planning and communicating with parents, principals and their peers. By and large principals and younger teachers were more favourably disposed to the accountability element of WFL while older teachers were more circumspect about this aspect of the programme.

"I feel that it is actually in some kind of deep down way a system of making teachers accountable. It's a way of getting at teachers. A form or public accountability if you like. But I think that is coming anyway and whether teachers like it or not they will have to put up with it because it's about openness, transparency, accountability and access to records and new education acts. So WFL would fall into all that.

Vice Principal, Site 2

"Wired for Learning is making us more accountable and responsible. If I don't respond to a parent with a message, well then it's in print with the date, the time is on it and if I don't respond I'm not doing my job. So there is accountability in that your principal knows that information was passed on and it's up to me to respond. If I don't, I'm not doing my job either as a subject teacher or class teacher."

Teacher 2, Site 2

"I think Wired for Learning improves accountability because there is a very organised and definite format for reporting and discussion."

Teacher, Site 1

"When we used WFL for our policies and planning we got more opinions and more discussion and then when we finally agreed on things nobody could say well actually that wasn't what I said – because it was all there, so you could look back at it, even if you weren't sure of it yourself and thought afterwards – why did I agree to that? You could look back and see – oh yes I did."

IT coordinator, Site 1

"It's great for having things at the press of a button rather than on pieces of paper. It's easier to put things into WFL and it means that there is a record there as well because sometimes you tell things to people, not at management level, but at teacher level, and then you are 6 months later that they never heard of it. Whereas if it's on WFL you can say, go back, and look it's there and that's agreed".

Principal, Site 2

Business/Education Partnerships

In his book "Revisiting the Culture of Schools and the Problem of Change", Sarason (1996) argues that "many teachers are only interested in what they do and are confronted with in their encapsulated classrooms in their encapsulated schools." This is why change from within the system can be so difficult to achieve. The truth of the matter he maintains is that the pressures for change have to come from outside the school system. Fullan (1991) too maintains that without external pressures for change many new programs would never get adopted in schools.

It is probably true to say that if "Schools IT 2000" endorsed the principle of business/education partnerships, then Wired for Learning is the exemplar of this principle in practice. Alone of all the SIP projects it involved a partnership where a business was actively involved in a very direct way with schools rather than as a silent partner which merely provided money and resources that represented the beginning and the end of its involvement. This created many unique challenges both for schools and for IBM as each strove to understand the cultural norms and practices that guided each others' modus operandi.

As already outlined in chapter five the fact that schools had no prior experience of working with the private sector meant the task of bridging the gap between the corporate culture and the school culture was a formidable one. It took time to work through many of the cultural differences, many of which manifested themselves as suspicions about corporate involvement with schools. Many teachers felt that IBM didn't really understand how schools operated and resented their level of involvement with schools through this project. Some teachers felt that IBM's involvement was just a ploy to sell more computers, others felt it was a way of trying to get schools to operate more like businesses. The sincerity of IBM's motives was particularly called into question when it did not come up with an attractive enough deal for teachers to purchase their own computers. The change management course provided by IBM was attacked on the basis of its 'corporate-speak' and that it was irrelevant to how schools operated. Some teachers were appalled that IBM never once mentioned 'the child' in

all their deliberations with teachers, and as far as teachers were concerned 'the child' is the centre of the school's universe and for many, the sole source of their job satisfaction. Inevitably any organisation or any new program in which the child did not appear to be accorded central place, was destined to receive a very hard time from teachers.

If teachers felt that IBM did not understand their culture, then it can be equally said that they themselves displayed little understanding of the business culture within which IBM WFL personnel were operating. By expecting everything to be in perfect working order and to operate within the strict boundaries of teachers clock time and the rigidities of the teaching calendar year, which is a lot shorter than the normal business year, they clearly lacked any real insights into the world of business. The risk taking culture which permeates the IT business sector and within which experimental projects like WFL can emerge and be piloted in uncharted territory and where outcomes are not pre-determined, is not a concept with which too many teachers can readily identify, precisely because the culture of teaching is so risk averse. What they perceived as 'sloppiness' in terms of IBM's management of the project and which they then interpreted as a 'cavalier' attitude towards schools was in many ways just part and parcel of normal 'slippage' in a project management timeline due to the appearance of 'unscheduled events'. In the end of the day teachers failed to appreciate that the WFL project was not run by an infallible computer program but rather by human beings, prone to human error, working in an enterprise where they were expected to support and manage many other projects in addition to WFL. Unlike teachers, workers in this type of culture do not operate in an encapsulated environment where they can devote almost 100% of their professional energies to a single task. For most business professionals the ability to multi-task and to juggle shifting project priorities is a key requirement of the job. Because teachers work in such a regulated, orderly environment where everything has its place, it was difficult for them to understand the norms and practices of the corporate world and this created misunderstandings which slowed project progress especially during the start-up up and early implementation months.

One could probably argue that if DES had played a more active role in the project that it could have helped bridged the gap between the school and business cultures and smoothed out the problems that emerged. If they had really been committed to WFL and its vision of changing schools, surely they and not IBM should have organised the change management course for schools and did they not at least vet the content, and if not, why not? A course of this nature with their imprimatur would have carried far more weight with teachers and would probably have been more positively received. But maybe as one principal explained, DES simply didn't have this level of expertise:

I know it might sound awfully harsh but I don't see any great signs of visionaries in the Department of Education. I don't think there is any expertise in there to actually deliver change management training and that would be one of the reasons why I would like to see the business/school partnership thing promoted if it's going to deliver on something like that."

When it came to business/school partnerships clearly mistakes were made on all sides. These mistakes primarily emerged because the norms and values which inform practice in different cultural environments were not understood by the different parties. As a result of these misunderstanding some 'basic assumptions' about school organisational life emerged which future projects involving closely tied business/school partnerships will need to pay careful attention to, not least of them being school's understanding of themselves as 'unique organisations'. The deep rooted nature of this widely held belief is why Sarason (1996) argues that schools remain unresponsive to the need for change, don't see how lessons learned about change in other organisations can be applied to them, and why we can no longer expect that schools can be changed from within without pressure from those outside the school system.

Section Three

Theoretical Considerations

Introduction

According to Huberman and Miles (1994), research typically moves through a series of analytical episodes to reach a coherent understanding of What happened, how it happened (Description) and Why it happened (Explanation). Citing Bernard (1989) they define explanation, as the process of “making complicated things understandable according to some rules – or theory” (p.90). Although very few qualitative researchers are concerned with the creation of grand theories, researchers using the interpretive-descriptive analysis paradigm use well known theories in order to give a broader context to their work and to encourage more critical reflection based on all available information. A good theory, as Glaser (1978), cited in Matthew, Huberman & Miles (1994), suggests is one which “fits the data, is relevant to the core of what is going on and can be used to explain, predict and interpret what is going on” (p. 144).

Using this definition and bearing in mind that this research intersects two dominant themes in current educational discourse, namely ICT integration in schools and change in schools, I think it is important to broaden the scope of the analysis to include an examination of theories relevant to this study. These theories should help to shed additional light on the case study data and the findings and issues discussed in the two previous sections. The three most relevant theories to be discussed relate to:

- **ICT Integration**
- **Diffusion of Innovations**
- **Change and Schools**

ICT Integration

As the drive to computerise schools throughout the developed world has gathered momentum during the 1990's, researchers and policy makers have turned their attention to understanding the process by which schools and teachers adopt to new technologies and integrate them into their teaching. A growing body of literature is now emerging which identifies the stages or steps which schools and teachers progress through as their IT competency evolves.

The stages of ICT integration as first outlined by Dwyer et al. (1991) as a result of their longitudinal study of Apple Computer's classrooms of Tomorrow (ACOT) project, and which has subsequently been adapted by other researchers, (Mandinach & Clyne, 1994; Dyrli & Kinnaman, 1995; Hooper & Rieiber, 1995; Yocam, 1996; CEO Forum STAR Report 2000; Becta 2001b) provides a robust theoretical framework within which the experiences of both the WFL schools and the Thin Client schools can be more fully understood. By viewing the ICT integration process as a series of stages through which both teachers and schools have to travel, this model offers a perspective for evaluating the evolutionary nature of ICT integration throughout a school over time.

The value in adopting a stage by stage perspective on ICT integration is that it helps to demystify what can sometimes seem like a very complex, confusing and chaotic process. In addition it also offers a reference point against which progress can be judged while at the same time offering a blueprint for future development. Naturally, these stages are not cast in stone because as this is a developmental model there can be considerable overlap between the different stages. Furthermore a linear progression through the various stages can not be taken as a given, as difficulties encountered along the way can stymie progress and result in stalemate and in some cases, a regression to an earlier stage in the process. The attached matrix presents the key stages which have been identified by various researchers and outlines some of the key features which have been ascribed to each stage of the process.

Stages Characteristic of ICT Integration Processes

Key Features	ACOT 1991	Mandinach & Clyne 1994	Hooper & Rieber 1995	BECTA 2001b
Initial exposure to hardware & software; Once off Training; Traditional teaching; Sporadic engagement; Classroom management & discipline concerns. IT coordinator acts as a 'firefighter'	Entry	S U R V I V A L	Familiarization	Localised
Tentative engagement; Emphasis on how to use basic technology tools and applications i.e Drill and Practice ";Traditional teaching methodologies; concerns focus on using technology; seek technical assistance from colleagues.	Adoption		Utilization	Co-ordinated
Break through time; Staff Decide to embrace medium; Teacher efforts directed at integrating technology into traditional classroom practice; Teachers concerned with identifying and using grade, age and subject specific multi-media More active student engagement.	Adaptation	Mastery	Integration	Transformative
Mastery of the medium; Teachers use curriculum and administrative IT fluently; Innovative teaching & learning strategies emerge; IT is integrated into staff development rather than treated as a separate issue; Increased collaboration around instructional topics & more collegial interaction	Appropriation	Impact	Reorientation	Embedded
Teachers are prepared to develop new learning environments utilising technology as a flexible tool; A move from behaviourist to constructivist learning. Emphasis on Collaborative learning where students can develop teamwork, communication & problem solving skills;	Invention	Innovation	Evolution	Innovative

Applying this theoretical framework to the WFL project, we can see that when the project started the majority of teachers were at the 'Entry/Familiarisation' stage 'in terms of their ICT development and the deployment of WFL. As a result of the investment that the project made in both infrastructure and training, all schools had entered the 'Adoption/Utilization' stage by the end of the first year of the project's implementation. Furthermore encouraging signs emerging from school three appeared to indicate that it was on the verge of entering stage three, the 'Adaptation/Integration' phase in terms of its deployment of WFL. Progress through stage two was proceeding at a slower pace in the remaining schools with schools four and five displaying signs that they were encountering difficulties which, while ostensibly project-related, were in fact symptomatic of underlying problems relating to school leadership and school culture. These problems not only threatened their integration of WFL in terms of progressing to the next stage but were of significant magnitude to potentially cause a regression in the entire process that they had undergone up to that point.

When this model is applied to the Thin Client project, it's clear to see that the school had already reached the 'adoption/utilization stage' of ICT integration by the time the project arrived. Looking at the school's ICT history, it's probably true to say that the school had been stuck at this stage for quite a number of years. It seems likely that this can be attributed to a combination of lack of adequate hardware (both quantity and quality) and to the traditional diffusion pattern of innovations, as defined by Rogers (1983), which will be discussed in the next section. The arrival of a state of the art, well resourced technical infrastructure, at a time when there was a national drive to implement technology in schools, appeared to catapult the school's ICT development almost overnight into the Adaptation/Integration stage, a phase which was well underway by the time my research involvement with the school finished.

Whether the school will move beyond this stage is probably a moot point because as Hopper and Rieber (1995) point out most educational technology integration to date is limited to the first three phases of integration, with few enough schools actually reaching the adoption/utilization phase, and usually remaining stuck there when they

finally reach it. They argue, and I agree, that the stages of technology integration can be defined by a 'magical' line representing a continuum from behaviourism to constructivism. Consequently many educators stall at the 'Adaptation/Integration' phase because they find it difficult to make that quantum leap from a traditional behavioral conception of learning to a constructivist understanding of the learning process. Making this switch can be extremely difficult precisely because it requires a transformation not only of one's learning philosophy but also in the way schools are organised and structured for learning. This is a much bigger task which technology alone cannot instigate, although it can facilitate the process once philosophical and structural issues are addressed.

Diffusion of Innovation Theory

If the stages of integration theory provides a framework for understanding ICT integration as an evolutionary process, then the diffusion of innovation theory helps us understand the way in which technological innovations are adopted by members of an organisation. Rogers (1983) defined diffusion as "the process by which an innovation is communicated through certain channels over time among members of a social system" (p.35). The essence of this theory is that it takes time for members of a social system to adopt technological innovations and that the actual integration of an innovation will vary according to the innovation profile of an organisation's members. According to Rogers theory the rate of adoption for any innovation can be plotted on a graph to form an S-shaped curve which will be shaped by the members innovation profiles, of which there are five types.: (1) Innovators, (2) Early adopters, (3) early majority (4) late majority, and (5) laggards.

Innovators who represent 2.5% of the population are usually responsible for introducing an innovation into an organisation and are the first to adopt it. Early Adopters, representing 13.5% of the population are the next to adopt. Although innovative in their own right they are more cautious than innovators in their approach and usually serve as good role models for other members in the social system and act as 'Opinion Leaders'. However it is not until the early majority, representing 34% of the population, adopts, that an innovation really begins to take hold. This group who deliberate at length before adopting an innovation, provide a critical link between the

trail blazers (i.e. innovators and early adopters) and the more sceptical and traditional types, i.e. the late majority, representing 34% of the population and laggards, representing 16%, thereby cementing the interconnectedness of the social system which in turn provides the conditions within which an innovation can begin to flourish. Peer pressure and changing system norms influence the adoption decisions of the late majority, who will usually adopt new ideas just after the average member of a social system. Laggards or 'resistors' who are conservative and traditional in outlook, and whose 'point of reference remains the past', are the last to adopt an innovation and often by the time they adopt it, the original innovation may be superseded by a new idea that is already being used by the innovators.

The significance of this theory for this study is it tells us that the actual integration of a technological innovation like ICT and therefore its use, will not be evenly applied throughout a school during the adoption period, because the rate of adoption will vary according to the innovative profiles of its members. The Thin Client school is a case in point. Here we can see how the initial introduction of ICT came about as a result of the efforts of the innovators i.e. the Principal and IT coordinator and slowly diffused throughout the organisation over time. Initially a small number of teachers, (early adopters), started to experiment with the technology until eventually the early and late majority started to come on board, by the time the thin client project arrived in the school. True to form, two teachers (sic. Laggards) have yet to be convinced to adopt the innovation. When one considers that laggards usually represent 16% of the population, two out of a staff of 14 is a very low number and therefore very encouraging. This means that the innovation has almost reached a 100% adoption rate and therefore can be regarded as complete.

That is not to say that a near 100% adoption rate is always required for completion. Rogers himself (1995) defines completion in terms of routinization which "occurs when an innovation has become incorporated into the regular activities of the organisation, and the innovation loses its separate identity" (p.399). The case study data from the thin client school clearly demonstrates that ICT has been incorporated into the regular activities of the school and that teachers have begun to think of ICT

as a tool to support their work and have started to use it that way, rather than treating it as a separate activity. In other words the innovation has lost its separate identity.

Compared to the Thin Client school, most of the WFL schools have had a much shorter history of involvement with ICT and therefore when the project commenced they were at a much earlier stage along the ICT integration continuum. The slow progress which the project appears to be making in some quarters should not therefore be necessarily interpreted as all doom and gloom. Using Rogers theory as a model and the experience of the Thin Client school as a reference, it may just well be that the WFL innovation still has a long way yet to travel along the 'S' curve before the innovation can be more widely adopted and deployed throughout the schools.

Change in Schools

Because the Wired for Learning project was designed to promote school change using technology as a medium to facilitate the change process, both schools and their teachers faced many challenges as they strove to come to terms with both the vehicle of change, i.e the WFL platform and change itself. Different change writers have proposed different theoretical models to explain the change process as it affects schools and organisations such as the 'Concerns-Based Adoption Model' (Hall and Hord, 1987), the 'Leadership Obstacle Course' (Herriot & Gross 1979) and the 'Sociotechnical Model of Organisational Change' (Leavitt 1965). Although different theories account for different aspects of the change process the one common thread uniting all change theories concerns the developmental nature of change itself as most change theorists see change as something which happens through a series of steps or stages. Change as Hall & Hord (1987) reminds us is a "process not an event" (p. 8) or as Fullan (1993) phrases it "Change is a journey not a blueprint" (p. 21).

One of the most comprehensive theories of change as it applies to school was provided by Fullan (1982) and subsequently refined by him in 1991. He defines change as a 'multi-dimensional' process in which at least three components are at stake: (1) changes in teaching materials such as the introduction of new curriculum

materials or new technologies (2) changes in teaching approaches such as new teaching strategies or activities, and (3) changes in teacher's beliefs (i.e. what people do and think.). For change to be successfully implemented it must be implemented at all three levels and in the process take account of both the 'objective reality of the innovation and the subjective reality of individuals'. Fullan maintains that many change efforts in schools fail because there is an overemphasis on the objective realities of the innovation without due acknowledgement of the subjective realities for teachers caught up in the change process. As a result new programs are frequently introduced and described in terms of program goals and supposed benefits rather than in terms of how the changes will affect teachers personally when it comes to their classroom activities and the amount of extra work that will be required of them outside of class. In other words "change is not usually introduced in a way which takes into account the subjective reality of teachers", resulting in at best, superficial change, and at worst, no change. When this happens

"There is a strong tendency for people to adjust to the 'near occasion of change,' by changing as little as possible – either assimilating or abandoning changes which they have initially been willing to try, or fighting or ignoring imposed change" (p. 29).

Failure to take into consideration teachers subjective realities both before and during the implementation of an innovation sounds the death knell for most change reform efforts because ultimately for real change to happen, teacher's beliefs and role conceptions must be changed. This cannot happen if the concerns of those most affected by change are not acknowledged, and therefore effectively ignored. As a result teachers and those promoting change may think that change has happened because teachers are using new curriculum materials or new technologies, when in fact they have only 'assimilated the illusive patterns of the new innovation' because neither teaching strategies nor teaching beliefs have changed. As Fullan reminds us the conception of an innovation "as a set of materials and resources is the most visible aspect of change, and the easiest to employ. Changes in beliefs are much more difficult to achieve because they challenge the core values held by individuals regarding the purpose of education". We know from cultural theory that beliefs are culturally conditioned and therefore difficult to change because they are buried at the level of unstated basic assumptions. Unlocking this bolt is the key to meaningful

change and the most difficult to achieve because it involves some very deep changes that challenge both the culture of teaching and the structure of schools.

That is why Cuban (1988), argues that innovations which involve 'first order changes' have a much greater chance of success in schools than those which involve 'second order changes.' According to his theory first order changes are those which aim to improve the quality of what already exists "without disturbing the basic organizational features or altering the way children and adults perform their roles." In contrast second order changes seek to transform the ways in which organisations are structured which includes re-organising the roles and responsibilities of those working in them. Such innovations largely founder because of "dominant cultural beliefs about what teaching, learning, and proper knowledge are and how schools are organised for instruction" (Cuban, 1993a, p. 207).

Clearly WFL with its emphasis on systemic change in schools using a technologically mediated environment to facilitate this change is an example of an innovation requiring second order changes. Therefore it is hardly surprising that many issues which surfaced in the course of this research were intimately related to the subjective realities of teachers and implicit, deeply held cultural beliefs about the nature of teaching and schooling.

Chapter Eight

Conclusions and Recommendations

Introduction

This dissertation set out to explore the impact of two innovative technology projects as they were introduced into schools under the impetus of the “Schools IT 2000” initiative. In many ways it was a unique, once-off opportunity to conduct an in-depth qualitative study on the process of ICT integration and innovation and the school system’s response to change as these innovations were implemented. The bulk of my intense fieldwork and primary research data was gathered during the first critical year of the innovations’ introduction (1999/2000) into their respective schools. The case study vignettes and the data analysis as presented in chapters five, six and seven was largely grounded in that data with the added proviso, as already indicated in chapter four, of additional insights into school progress during the following years 2001 and 2002, gained through interactions with NCTE and IBM during 2002 when I agreed to prepare on their behalf an ‘Interim Report’ on the WFL project for DES.

Current Situation – Thin Client

In order to maintain a consistency of approach between the WFL project and the Thin Client project, I made an additional visit to the Thin Client School at the end of March 2002 where I conducted a project follow-up interview with the IT coordinator. At this stage the two year project period had come to a close and the IT coordinator was back teaching fulltime. This visit revealed that while the ‘laggards’ were still resisting going to the computer lab all other teachers were using it regularly as part of their normal teaching routine. Overall the IT coordinator regards their Thin Client project as a win/win story and feels that pupil exposure to technology has expanded significantly since the installation of the thin client infrastructure as teachers now use technology a lot more in their teaching. True to his ‘innovative’ nature he was in the process of submitting another pilot project to the NCTE and DES, codenamed

‘Hermes’, that would involve the networking of six local schools onto their school’s thin client server. For this project it is envisaged that school 6 would house a ‘server farm’, which the IT coordinator would administer, thus eliminating system administration tasks and maintenance problems at the local level. At the time of my visit in March 2002, the IT coordinator already had a test system up and running for six months on a trial basis with a school located seven and a half kilometres away, where three NC’s were regularly logging onto the thin client server in school 6 and accessing the web and other resources from this system.

Since then, to assist in moving the project forward, the NCTE requested me in October 2002 to evaluate the existing project proposal for ‘Hermes’ and to assess its feasibility. In my evaluation report on the proposal I made a strong recommendation that DES should support the extension of the thin client solution based on a server farm model using wireless loop technology to the six local schools provided the project scope was extended to include a strong pedagogic dimension which I felt was lacking in the original project proposal, where the overriding emphasis was on the technical infrastructure. In my opinion there was a naive assumption in the original ‘Hermes’ proposal that linking schools together via the server farm would automatically lead to more ICT usage at school level and that schools would automatically collaborate once the technology was put in place. However as the experience of a project like for example, Wired for Learning demonstrates, it is wrong to assume that technology alone can make this happen, as other change drivers such as leadership and vision, organizational development, staff professional development and a commitment to change, need to be factored in. I recommended therefore that the proposed participating schools should be required to provide more evidence to DES of how they envisaged increased ICT usage coming about and how they intended to collaborate as a group in enhancing the learning environment for staff and students. I also recommended that given the pioneering nature of this project and the high financial costs associated with it, that adequate provision for the conduct of ongoing formative research and evaluation needed to be built into the project plan.

Based on this analysis and my recommendations DES has agreed in principle, as of December 2002, to support the Hermes project. As things currently stand, the NCTE has contracted me to work with the IT coordinator from school 6, who would in effect act as the project manager for Hermes if it gets the go ahead, to put together a project plan which would address both the pedagogic and technical elements of the project and around which an appropriate evaluation framework would be structured. This plan would need to be acceptable to DES and be capable of securing the buy-in from all schools. Work on this revised project plan is currently underway and if all goes well, it is likely that the Hermes project will be supported by DES through the auspices of the NCTE for a period of 18 months approximately, commencing in March 2003.

Current Situation – WFL (Sites One and Two)

As originally envisaged, the WFL project was a three year project and was officially due to finish in June 2002. Recently however, DES has agreed to extend the project for another year until June 2003. In order to keep this research as current as possible I conducted a brief visit to each of the five WFL schools at the end of September 2002, prior to writing this concluding chapter. The visits consisted of a focussed meeting with the principals and IT coordinators in the schools where I had the opportunity to discuss with them their perspective on the how the project had evolved in the schools over time and its current status.

In the case of the site one schools, I had joint meetings with the principal and IT coordinators in schools one and two. In school five I met with the IT coordinator only, although the principal had intended to come but was called away on urgent business at the last minute. These meetings lasted just over an hour. In the case of site two, I met with both schools together. This meeting lasted for just over two hours and there were eight attendees in all, four from each school comprising the principals, vice principals, IT coordinators and assistant IT coordinators. At the end of the meeting I also had the opportunity for a further half hour discussion with the vice principal, IT coordinator and assistant coordinator from school four.

Based on these updated meetings with the schools I am now of the opinion that while a number of interesting developments have taken place, the major issues and challenges which I identified in chapter seven still remain, apart from the project implementation issues where the passage of time appears to have eroded the memory of a painful birth. However on the question of project ownership, I detected signs that the site one schools are still struggling with this issue, although I think that there is a strong likelihood that the extra project year may assist school one in overcoming this hurdle. I am less confident that it will benefit school two and particularly school five in this way.

Perhaps most encouraging though is the extent to which School four has managed to resolve its difficulties and has since developed a sense of ownership for the project as a school. In the aftermath of the IT coordinator's resignation, the project went into limbo, or encountered an implementation dip, as Fullan (1991) would phrase it, for a period of six months. This gave everyone time and space to reflect on what had happened. The IT coordinator was eventually persuaded to come back on board as project coordinator but her workload was greatly reduced as the principal, vice principal and assistant IT coordinator took a much more active role in supporting the project. Moreover the IT coordinator has become much more accepting about the difference between her own personal ambitions for WFL and those of her colleagues. She has also become much more realistic about what she alone can deliver and she now delegates more and works through the other post holders in the school, who effectively operate as a middle management layer, to keep the WFL momentum going, enough, but not too much. Leveraging the power of this 'opinion network' to support WFL has undoubtedly accelerated the rate of adoption of the innovation and has helped a sense of ownership of the project to develop throughout the school.

It would also seem that the difficulties encountered during year one have benefited the school leadership. By all accounts the principal has become much more decisive not just about WFL matters but all other issues as well since the crisis and this has had a positive effect on school and staff morale. Furthermore the representatives from school four all agreed that as a result of the WFL project they have become much

more skilled in IT as a staff and as a school and much more open to 'general change'. As the vice principal said at the meeting 'this project has really moved us on as a staff at all levels.'

Current Situation – WFL (Site Three)

I mentioned in chapter two that a third WFL site, based in Dundalk came on-stream in 2000, just as my field research on the first two pilot sites was nearing completion. Although an in-depth study of this site was outside the scope of this research, there are a number of interesting features about this model, which are worth mentioning at this stage, particularly as there have been some recent developments in relation to my role as a potential evaluator for this third WFL site in 2003.

The Wired for Learning project in Dundalk evolved from a community led initiative known as the Dundalk Learning Network (DLN) which applied for funding under SIP to establish a connected learning community in the region to include schools, the community and local enterprise. In their SIP submission the DLN applied for funding to develop the use of web-based technologies to enhance communication between schools and between schools and the wider community. As the synergies between their proposal and the aims of WFL were quite apparent, the NCTE SIP national co-ordinator encouraged them to *refine their plans* with a view to becoming the third WFL site in the joint IBM/DES WFL initiative for Ireland. This they duly did and as a result a total of eight schools became part of the Dundalk Learning Network WFL project when the project was officially launched in 2000. A further nine schools were admitted to the project at the beginning of the academic year 2001/2002. Effectively this means that 17 schools are now participating in the project. From this brief outline it is clear that in terms of its origins, size and scope, the third WFL site is quite different from the first two pilot sites.

The manner in which the DLN WFL project is structured and organised also sets it apart from the pilot sites. The project is run and managed by a full time coordinator, originally a local primary school teacher, who is now on secondment for the duration

of the project. He acts as the interface between the schools, the NCTE and IBM, which effectively means that neither IBM nor the NCTE have any direct contact with the schools, apart from when they organise and run site WFL meetings (on average twice a year) that is attended by school personnel from all three WFL sites.

The coordinator runs the project from a central office based at the Dundalk Institute of Technology, one of DLN's project partners. All the DLN WFL schools are connected to a central server located here, from where they access the WFL site which is centrally managed and controlled by the DLN WFL coordinator, who looks after all the technical maintenance of the server and troubleshoots problems as they arise. This removes the technical burden of administering and maintaining the WFL site and software from the individual schools. The IT coordinator is also responsible for directing the pedagogic development of the project and he is actively involved in working with schools and teachers in encouraging them to use different WFL applications to support the curriculum. Under his direction a number of cross site teams have been established to develop the use of WFL to support curriculum development, team projects, inter-school collaboration and literacy development. Although unsubstantiated yet by formal research data, anecdotal evidence emerging to date would suggest that this model has been quite successful and probably the way forward for any future rollout of the WFL project. Now entering its third year of operation, this site is now ripe for evaluation and IBM are keen to have an evaluation conducted. Consequently IBM has recently approached me about undertaking an evaluation of the DLN WFL project. These discussions are now ongoing and subject to further negotiations the evaluation is likely to commence in March 2003 with a view to completion by August 2003.

The Original Research Questions Re-visited

When I commenced this study I based the research design around six key questions, which I used to give a focus to this research. The questions posed sought to gain insights into the following areas:

1. The structural and organisational requirements for effective ICT use in schools
2. Teachers, technology and change
3. The adequacy of the ICT infrastructure for supporting the task of ICT integration
4. The extent to which a collaborative and communications technology can encourage a culture of openness and sharing in the school environment
5. The adequacy of training received to support the innovation and the level of staff competency required for effective use of ICT
6. The sustainability and scalability of the innovations.

In the data analysis chapter I chose not to report out the findings question by question in order that the emic issues which emerged could be voiced in a more holistic and cohesive way. In this concluding chapter I now wish to briefly address the original research questions in the light of what the original data and the more recent follow-up visits have revealed.

Research Question 1: The structural and organisational requirements for effective ICT use in schools

The findings from this research confirm the central role of school leadership in supporting the implementation of ICT in schools. By definition leadership encompasses the role played by the principal and the support of the larger administration system, which in this case means DES and the Inspectorate. If teachers don't receive strong signals from these sources that ICT use is a priority, then its use

in a school is likely to be limited and marginalized. School leadership then is a key organisational requirement, not least because it plays a vital role in ensuring that the right structures are in place to support teachers in their use of ICT. These structures include personnel such as IT coordinators and their assistants, a robust and reliable infrastructure, technical support and staff development and training.

When it comes to an innovation like ICT the IT coordinator's role is crucial. I think it is clear from this research that without the tireless support, dedication and commitment of the IT coordinators and their assistants, very little development in ICT would have taken place. It is a highly skilled job that demands excellent leadership skills as well as an excellent technical ability. The IT coordinator has to be able to influence other staff members to adopt ICT and use it as part of their teaching and be technically capable of supporting them in their efforts to do so. He or she must also be capable of maintaining the school's technical infrastructure, advising on upgrades and new developments and identifying suitable teaching software. This makes it a very demanding post and therefore it is best if responsibility for the school's ICT development can be shared among other members of staff under the leadership of the IT coordinator working in conjunction with the school principal. Such a model would ensure that a school's ICT development would not adversely suffer if the IT coordinator resigned to go elsewhere or had a long leave of absence through illness or a career break.

I think this research has also demonstrated that the ability to manage change and understand the dynamics of change is an essential leadership component when it comes to ICT and its use in schools. Change and ICT are intricately linked precisely because ICT itself is always changing. What is considered state of the art and fashionable today can and will be rendered obsolete within a very short timeframe in accordance with Moore's law of technological innovation. School leaders need to be aware of this and prepare their staff for the need for ongoing training and development in ICT as technology develops. This represents a big challenge because there is a very real danger that staff will feel that because they have mastered current technology there is no need for further IT development. Furthermore while many of

today's technology tools are used to support and reinforce traditional teaching and classroom practices, future, more radical designs, combined with educational policy decisions may facilitate the introduction of more constructivist teaching and learning environments. This will require big changes in the way schools are organised for instruction and how teaching will be delivered. It is imperative therefore that ICT is viewed as an evolving ever changing technology which will continue to put pressure on society and its institutions, of which school are a major constituent, to change on a regular basis. The ability of schools to continually accommodate and effectively use new technologies will depend on their organisational capabilities in introducing and managing change.

Research Question 2: Teachers, Technology and Change

This research question sought to explore what teachers perceptions about the respective innovations and their willingness to use new technology revealed about teacher's attitude to change. It is true to say that the WFL innovation which directly challenged existing teaching practices precisely because it was designed to change them was more revealing in this respect than the Thin Client innovation. I think this research demonstrates that teachers in most schools have been very reluctant to engage with the Wired for Learning tools which would affect them most directly in terms of change i.e. the instructional planner and private conferencing. As I have discussed in detail in chapter seven teacher beliefs about the nature of classroom teaching and the traditional isolationist culture of teaching prevented them from using and adopting the instructional planner to support their work and sharing lesson notes and plans with each other. My return visits to the schools confirmed that this is still the case and all schools including school four who made a serious effort to use the instructional planner in year one, now no longer use it. In terms of WFL this has to be a big area of concern because the instructional planner is a cornerstone of the entire software package and a key means through which its designers envisaged systemic change in schools being realised.

In emphasising teacher's resistance to the use of the instructional planner based on cultural conditioning and a reluctance to change, I do not wish to appear to be

trivialising the legitimate criticisms that many teachers made about the instructional planner not suiting the Irish system. However the fact is that it can actually be modified and changed at local level to suit the Irish system and while the coordinator in school four indicated that she would be prepared to adapt it, the teachers have said that they would still not be willing to use it. Furthermore at my most recent meeting the vice principal of school four very clearly stated that if DES decided tomorrow that teachers had to submit unit plans and lesson plans in accordance with WFL's format that objections would soon disappear and teachers would take it on board, modifications or not. This suggests that most teachers will neither initiate nor embrace change unless pressure is exerted on them from external bodies that are in a position to influence them to change.

In addition to the above, it should also be noted that many teachers reported that neither the introduction of WFL nor technology generally, which also includes thin client technology, had changed their teaching style. Very few teachers reported that technology changed their role in any way although many acknowledged that technology had the potential to do so in the future. Assessed in the light of Fullan's (1982;1991) theory of change as a multidimensional process involving three core strands consisting of (1) changes in teaching materials (2) changes in teaching approaches and (3) changes in teacher's beliefs, both innovations have yet to realise their full potential. Level one changes have occurred at all schools as teachers have begun to use new technology and there is clear evidence of level two changes in schools four and six but on the whole level three changes have yet to materialise.

Research Question 3: The adequacy of the ICT infrastructure for supporting the task of ICT integration

There can be no doubt but that the state of the art infrastructure installed in both the Thin Client and WFL schools was very well constructed to support the task of ICT integration. Apart from the 'time out error' problem in the Thin Client platform and the initial technical difficulties experienced by the WFL coordinators in relation to localisation and new software releases, technical problems reported by teachers were minimal. In the primary schools, the computer labs combined with the installation of classroom PC's gave teachers the best of both worlds when it came to using ICT as a

cross curricular tool. In the post primary schools the installation of an additional computer lab enabled them to make computer facilities available to support mainstream subject areas, where traditionally the emphasis had been on science, business studies and Transition Year. Furthermore the placement of six PC's in the staff annex in school three further facilitated the integration process by providing staff with convenient access to PC's and a 'safe' environment in which they could experiment with technology during the critical start-up phase. In the Thin Client project most teachers commented on the superiority of the new system compared to what had been there before. In the WFL project, many teachers commented that the infrastructure was one of the best things about the project. Across all schools pupil access to technology has greatly increased as a result of the infrastructure, which project participation brought.

Research Question 4: The extent to which a collaborative and communications technology can encourage a culture of openness and sharing in the school environment

The evidence from this research suggests that technology of itself has limited potential to make a difference in this arena unless deep-rooted beliefs about the school and teaching culture are changed. The traditional individualism of the teaching culture acts as a powerful restraint when a tool like WFL is introduced into the system. If a collaborative culture does not already exist in a school, a tool like WFL will not make it happen. A willingness to share and collaborate is a function of the organisational climate of the school which technology alone cannot change. There are also structural constraints that need to be acknowledged particularly in areas such as private conferencing. Lack of teacher time and low home PC ownership prohibit the development of this form of communications. Even more importantly teachers have expressed the need for clear guidelines from DES on the proper protocols for electronic communications, particularly with parents. In my most recent visit to the schools, this was again raised as an issue with three of the five schools quoting the Data Protection Act as a reason why teachers will not electronically communicate with parents.

Research Question 5: The adequacy of training received to support the innovation and the level of staff competency required for effective use of ICT

For the most part teachers were very satisfied with the training that they had received both in terms of general IT skills training and in the case of the WFL project, WFL specific training. In their opinion they were now more competent and confident in using IT. However the timeliness of training was an issue for the WFL IT coordinators who felt that core technical training and project management training was delivered too late. The Thin Client coordinator received no formal training and basically had to teach himself.

In the WFL project the adequacy and relevance of the change management training left much to be desired. It was deemed inappropriate for schools and irrelevant to their needs because teachers believe that schools operate very differently from business. Moreover the fact that change management training was confined mainly to principals and IT coordinators and not expanded out to the general teaching body, was clearly a mistake in a project that was primarily designed to bring about systemic change in schools.

While teachers expressed satisfaction with the amount and quality of training they had received, I think the evidence from this research would suggest that this in itself wasn't sufficient to make them effective users of ICT in terms of integrating IT into their mainstream teaching practices. It is important therefore to distinguish between the acquisition of IT skills and the actual deployment of ICT in the classroom. One does not necessarily lead to the other. Looking at the four primary schools featured in this research, it is clear that the two schools which have had a long history of ICT involvement have been much more successful in integrating ICT into mainstream teaching, by comparison with those schools which did not have this history. Significantly in both of these schools, the IT coordinators were innovators who had a vision about how ICT could be used to enhance and improve the learning environment and resisted becoming the 'computer teachers' by insisting that teachers take their own classes to the lab. Furthermore staffs in these schools have been receiving computer-training courses virtually every year for the past ten years and

both schools have established ICT policies that predate the 'Schools IT 2000' initiative. Therefore when it comes to understanding what level of staff competency is required for the effective use of ICT, a number of factors need to be taken into account which include:

- Time to allow for the Stages of Integration Model as originally proposed by the ACOT researchers
- A recognition of the need for ongoing staff development and training in ICT
- Pedagogical Leadership coupled with technical support from the IT coordinators and their assistants
- A school vision around ICT in which teachers are expected to use ICT as part of routine teaching and learning

Unless these conditions exist, it is unlikely that teachers will become effective ICT users.

Research Question 6: The sustainability and scalability of the innovation.

From the outset of this research process I firmly believed that the sustainability of both innovations was dependent upon the extent to which they became integrated into the school environment. In other words their removal would result in a huge loss to the school. In this respect the recent return visits to the schools was particularly revealing.

(a) Thin Client Sustainability

Addressing the thin client project first, it is undoubtedly a success story. The official SIP project finished a year ago and the system is now running as an integral part of the school environment without any outside support or help. The IT coordinator is back in class full time and spends approximately an hour to an hour and a half each day maintaining and administering the system. He is of the view that if he had installed a standard PC network he would need to devote more time to this task given

the amount of use the system now gets in the school. Last October the system experienced its first ever serious crash and was out of commission for five days as outside technicians had to be hired in to fix the problem. This was a big blow to the school as teachers really missed not having the technology available to them and were constantly on to him wondering when it would be fixed so that they could resume using the lab and their classroom computers. This incident illustrates the extent to which the use of technology has become integrated into the school environment and how teachers have come to depend on it as part of their normal teaching repertoire. The downside of course is that it also illustrates the weakness of a server-centric system like thin client because once the server goes down it takes everything else down with it. However one serious crash after two and a half years in operation is probably quite a good record and therefore needs to be judged in the context of the other overall benefits.

(b) WFL Sustainability

The situation with regard to the sustainability of the WFL innovation is mixed. The project has been very well integrated into the school environment in both site two schools but less so in the site one schools. In my most recent visits both schools three and four indicated that it would be a catastrophe if WFL was removed. Apart from the instructional planner and private conferencing with parents, they use all other features of WFL quite regularly such as Team Projects, Talk@School, Teachers Lounge, Private Conferencing between teachers, Mentors@School, the Calendar of Events and Home Pages. In both schools the system is working really well as an internal communications vehicle and as a window to the outside world where parents and the local community can log on at ease to see what's happening in the school. A real sense of ownership for WFL has developed at both schools. In school three the 'initiator' leadership style of the principal and the collective culture that exists in the school have undoubtedly played large part in this. In school four the crisis of the IT coordinator's resignation which precipitated a change in the principal's leadership style and the school's management of the project coupled with the school's collective culture have also been a big influence. Although the schools are still benefiting from 'teacher release time' as part of the SIP project support structure, I believe that the support for WFL will continue after this facility is removed. It will however need one

major additional resource if it is to survive and that is financial support to cover the leased line and internet maintenance charges which presently amount to €17,000 a year. The NCTE and DES are currently absorbing these costs. Both schools are quite clear that they could not sustain WFL if they have to fund these costs from current school resources.

The site one schools are in a similar situation with regard to the high costs of maintaining WFL and given their disadvantaged status meeting these costs is well nigh impossible for them. Leaving that outside however and assuming that WFL could run on air, the sustainability of WFL in the site one schools is doubtful, with the exception of school one where there is a 50/50 chance that it could survive. These schools seem to be particularly badly affected by the issue of staff turnover, which has had and is continuing to have a negative effect on the long-term sustainability of WFL. That being said there are issues individual to each school that are also taking their toll.

I see potential for WFL surviving in school one because from the very beginning the school led by the principal has exploited Teacher's Lounge as a way of facilitating staff meetings and policy decisions at school level. This has continued to grow and develop in the school and has now become the standard way of communications within the school. They have also introduced 'Home Pages' for students and 'Class Home Pages' in which different students in their respective classes take responsibility for updating the class home page on a monthly basis under the supervision of class teachers. This is a task which students enjoy and which according to the IT coordinator has added an extra dimension to the relationship between teachers and students and given students a sense of pride in their school and an ownership of class work. Of equal importance however is the fact that the current IT coordinator is relatively new as the original coordinator resigned from the school two years into the project. Although the principal admits that this was a big loss to the school, which almost jeopardised the WFL project and certainly stymied its progress, the school weathered the storm and the project has survived intact. Despite these developments however I still get the sense that the project has to be constantly driven by the

principal and IT coordinator, which indicates to me that a sense of ownership for WFL has not yet developed throughout the school. One has to ask what is going to happen to WFL when the school no longer benefits from 'teacher release time' and the principal no longer has to account to the NCTE and IBM for project progress? Will the will and energy to drive WFL still be there, especially if the school feels that WFL is no longer a priority for DES? Possibly one of the most telling comments at the most recent meeting was the revelation that the school principal doubts if their current inspector, who was appointed over a year ago, even knows about the existence of WFL in the school.

I think WFL is unlikely to survive at schools two and five. One of the major reasons why I don't see it surviving at school two is that I think WFL as a product has very little to offer a junior primary school. If teachers aren't using the instructional planner, the product becomes very lightweight for junior primary teachers. Of all teachers in the Irish school system, junior primary teachers have the most opportunity to work together and meet as a group as many of their pupils finish early and they have an extra hour each day where they can meet in class groups to discuss their work and to plan. They also have quite a lot of face-to-face interaction with parents who bring their children to school. For this cohort of teachers, electronic communications has less to offer. Despite these limitations however, I think a different style of leader probably would have found an imaginative way of exploiting certain features of the product and making them central to the school's *modus operandi*. However as Hall and Hord (1987) remind us principals whose predominant leadership style is 'responder' oriented tend to 'let things happen' unlike initiator principals who 'make things happen' or manager principals who 'help things happen'. Consequently responder style principals are less successful in implementing innovations.

In school five the lack of engagement of the principal with the project has obviously had a big impact on project implementation and success. Although the IT coordinator has achieved quite a lot with WFL as a resource tool with students, particularly with Team Projects, only a few other teachers appear to be using it on a regular basis to

support their work. In my most recent meeting with the IT coordinator she clearly stated that WFL can't run without system administration support and that once teacher release time is removed that she will no longer be willing to support WFL. As things stand she spends half of her ten hours of teacher release time administering WFL and 'cajoling' teachers to use the system. If she goes back teaching full time, she will not continue to support WFL as DES only provides one hour per week to her as IT coordinator to maintain and run the entire school computer network which consists of over 75 machines. She could not possibly manage the administration of WFL on top of that. The fact that the IT coordinator has the power to decide whether she will or will not continue to support WFL speaks volumes about the disengagement of the principal from the project and how little the project has positively impacted the school. She has clearly not received any signals from the principal and other teaching staff that WFL is something that the school would like to see continuing. In this situation the effort required of her to sustain WFL must hardly seem worthwhile.

It should also be pointed out that there will be a knock-on effect for the other two site one schools if the coordinator in school five withdraws her support for WFL as they both access WFL through this site. Effectively this means that the school five coordinator is the system administrator for schools one and two. It would be possible to install the WFL software on the servers in each of the other two schools but this means that they will have to take on the extra responsibility of WFL 'system administrators'. Arrangements will have to be put in place to train and support them in this task. But if the project support structures are removed, as they will be in June 2003, who is going to do this and are schools one and two even aware of school five's intentions?

Scalability

The key issue to be addressed in terms of the scalability of both innovations is whether these projects could and should be rolled out to other schools. Realistically speaking I don't think either project ought to be rolled out in their current form, without some significant changes taking place.

In terms of the thin client project I think much of the success around this project can be attributed to the unique relationship that existed between the principal and the IT coordinator, the school's collaborative and progressive culture and the outstanding technical abilities of the IT coordinator. It would be very hard to replicate these conditions at another school and therefore a project of this nature would be unlikely to meet with the same level of success. Even viewing the project from a purely technical standpoint, I think there would be very few school IT coordinators capable of managing such a technically complex project. I think this fact was very well expressed by one of the teachers in school six when he said: *"It requires an expert to run our system, so even if you could give every school £40,000, you can't give every school a Ken"*.

Nonetheless thin client has many advantages for schools as discussed in chapter three and in my opinion it offers a potentially attractive platform for schools especially when the real cost of administering and maintaining a school's network is measured in terms of its TCO. Therefore I think the server farm concept as proposed in the 'Hermes' project represents a viable model in terms of rolling out this technology solution to schools. At the very least it will help overcome the problem of 'how do you give every school a Ken'. Furthermore if schools commit fully to the revised project plan, it will provide an excellent test-bed for examining how a robust and reliable technological infrastructure combined with an active and committed network cluster can impact the pedagogical and cooperative practices of the participating schools.

For Wired for Learning to be successfully rolled out, a major change would be required by DES. They would need to be able to articulate a vision of how they want schools to change, how WFL can help schools bring about this change and be willing to acquire the necessary skills to support schools through the change process. Obviously this would be a hugely complex task, particularly in light of the current industrial relations climate in schools, which is very finely poised. Fundamentally however it needs to be acknowledged that WFL is not just about technology, it is much broader than that as it was designed to assist the process of bringing about

systemic change in schools. For it to work at this level the right support structures need to be in place. As Kronley (2000) reminds us:

Schools may be the most appropriate unit of change, but affecting change will not occur in most instances without support at the district level. How districts go about this process- and whether they choose to undertake it at all – is central to the success of any reform. The realisation that systemic reform necessitates both real commitment and active participation by systems themselves became increasingly clear to some foundations that initially had developed programs to better schools. They learned often through hard experience that the engagement of districts to facilitate rather than block reform is essential to transforming the teaching and learning that takes place in schools” (p. 7).

Unless there is a genuine commitment at national level to change in schools, WFL in my opinion is unlikely to realise its full potential and therefore question marks remain over its long-term sustainability. At the same time however one must remain open to the possibility that the evaluation of the DLN WFL model might shed a different light on some of the issues raised in this study and that therefore this verdict may need to be reassessed in the context of what that evaluation may reveal.

Recommendations

The Schools Integration Project facilitated the implementation of pilot innovative ICT projects from which learning outcomes would emerge. This study has attempted to capture the key learning experiences from two Sip projects as they were introduced and implemented in schools. In the process the researcher had to deal with two related and challenging themes in current educational discourse, namely, ICT integration in schools and change in schools. Based on the findings from this research I now wish to make a number of recommendations in relation to the following areas:

- **School Leadership.** If ICT is to achieve its full potential as a teaching and learning tool, school leaders, in particular the principal, need to understand the key leadership role which they play in promoting its development and encouraging teachers to make ICT part of their daily teaching repertoire. As this research has shown IT is not just about technology it is also about change and principals must acquire the skills necessary to build the organisational

capacity for change. As all the principals in this research testified they have not been prepared to play a change leadership role and they have received virtually no training for the job they do. I find it hard to think of any other large institution that has neglected the managerial training of its management staff in this way and in this respect this level of neglect must be regarded as a dereliction of duty. The training of principals is an area that clearly needs to be urgently addressed. In this respect it's encouraging to note two recent developments that will go some way towards redressing this situation. The first is the 'Leadership Development for Schools' programme aimed at principals, vice principals and other management staff which is due to commence in the current academic year. The second initiative is an ICT course recently introduced by the NCTE entitled 'ICT Planning and Advice for Schools' which has been specifically designed for principals.

- The role of the IT coordinator. To date there had been an overemphasis on the technical role of the IT coordinator without due acknowledgement of the complexity of this role in terms of the leadership and pedagogic demands of the post. I think there is a need for a more thorough analysis of the job specification from which a case could be made for according this role a higher status both in terms of managerial responsibility and financial reward compared to other posts of responsibility. Of course this would involve removing the position from the post of responsibility rank and according it a different status in the overall organisational structure. While I am aware that this suggestion would encounter fierce opposition if DES tried to implement it, the reality is if you want change to happen you have to start making changes in the system somewhere. I think this could be quite a good place to start, precisely because the role is relatively new and there are no precedents. Change will never happen if old moulds are not broken and new ones created.
- Technical Support. The Schools IT 2000 initiative has led to an exponential increase in the amount of computers in schools yet little thought appears to

have gone into the technical maintenance of these machines. The issue of technical support will need to be more formally addressed especially as machines become older and more subject to breakdowns and crashes. At present schools rely completely on the IT coordinator to solve technical problems as they arise but this is not a realistic long term solution as teachers, including IT coordinators, are not technicians as some of my interviewees reminded me. If teachers are expected to use ICT as part of their professional practice then they are as entitled to proper technical support as doctors, lawyers, office workers and university lecturers. There are no shortcuts. Professionals deserve professional standards. If policymakers and DES officials want teachers to take ICT seriously, then teachers need to see that they are serious about putting in the proper structures to support them in this task, and there can hardly be a better place to start than with the provision of proper technical support.

- **Teacher Professional Development.** The role of the teacher is central to the way ICT becomes integrated into teaching and learning. While there has been significant investment in teacher training as part of 'Schools IT 2000', much of this training has been focussed on the acquisition of skills. However as I have already pointed out the acquisition of IT skills does not necessarily lead to the deployment of ICT in the classroom. To become effective ICT users teachers need to be provided with more sophisticated professional development opportunities that can help them to explore and more fully engage with the pedagogic potential of ICT as a teaching and learning tool. It is important therefore that they are provided with time and space for further professional development in ICT that goes beyond mere skills acquisition.

As part of this development teachers should also be encouraged to reflect on the broader context of ICT and how it is changing their role and opening up new communication and learning possibilities between school, home and the world outside. As a professional body teachers need to recognize that their own development should not be neglected at the expense of their students, which it has often been in the past. In other words teachers need to think more

about developing themselves and not just their students. Through continuous professional development they should strive to become more reflective practitioners of their craft and demand opportunities to acquire the skills and tools necessary for influencing the various stakeholders in the educational enterprise.

- **Public/Private Partnerships.** It is generally acknowledged that the complexity of school ICT provision coupled with the cost of providing ICT services will require the development of public/private partnerships if investment in educational ICT is to remain current and up to date. This implies that public/private partnerships will continue to grow as the role of ICT in schools expands. As this research has indicated public/private partnerships in education poses many challenges, which will need to be addressed if schools, policymakers and businesses are to have productive working relationships.

The differences in organisational cultures, rewards, incentives and management solutions to problems and conflicts that exist between schools and businesses will need to be more clearly understood if future partnerships are to run more smoothly and avoid some of the issues which surfaced in the WFL project. DES officials will need to become a lot more proactive in how they handle their role as 'intermediaries' between schools and businesses as they interact with each other, and all sides need to value more the experiences that they each bring with them to the partnership. At a more strategic level policy makers need to decide exactly what private enterprise is capable of delivering to schools not just in terms of resources but also in expertise and maximise the advantage of partnership to deliver this expertise. Schools need to become more open to what business can offer them in terms of understanding the importance of continuous professional development and achieving organisational change. Equally business need to learn from schools about often forgotten values such as a duty of care, an environment where the individual matters and a vocational approach to work which frequently requires a big investment in time and effort with little or no opportunity for financial remuneration or reward. If partnership is to work, it can't be just a



one-way flow. Both sides need to more fully appreciate the other's position so that they can each learn and benefit from each other.

- **Research.** In the introduction and implementation of innovative projects, provision needs to be made up front for the conduct of formative research with shorter feedback loop mechanisms. This would enable a more 'action research' approach to emerge in relation to project implementation. This would assist policy makers in becoming more informed about emerging issues in relation to project developments and enable them to make appropriate interventions and improvements at a much earlier stage in the innovation life cycle. In addition there needs to be a greater appreciation of the role which in-depth qualitative research can play in enhancing understanding of the subliminal and less visible issues which affect the progress of innovative projects. Uncovering and coming to grips with these issues will assist policy formation and implementation over the long term. However it needs to be acknowledged that this type of research is very labour intensive and therefore expensive. It cannot be done properly without the right kind of support and assistance being put in place.

Suggestions for Future Research

In the course of this research a number of interesting issues emerged which are worthy of further investigation. These include:

- **More observation studies of ICT use:** There is a greater need for policy-makers, software designers and teachers themselves to understand exactly how children are benefiting from the use of ICT, where are the shortfalls and how they can be addressed by different types of software programs and teaching strategies. To achieve this understanding a lot more research is needed at classroom and computer lab level. I think observation studies represent one of the best ways in which this information can be gleaned.

- At what age should children be introduced to computers as part of their formal education? Are young children really benefiting from computer use at a very early age or do they benefit more educationally from manipulatives and more tactile oriented activities up to a certain age level? Obviously this is a research area that would probably be best addressed by researchers with a background in child psychology and early learning working in conjunction with researchers with ICT expertise.
- To what extent do children from different socio-economic backgrounds experience different types of ICT access in school and a different type of ICT educational exposure? What are the underlying causes for this and how can this inequality be addressed?
- Computer room ergonomics. Are school computer labs sufficiently well designed to minimise ergonomic injuries and do teaching staff understand the ergonomic implications of prolonged computer use for themselves and the students they supervise. Have they received proper training? Do schools understand the implications of Health and Safety legislation in relation to workstation ergonomics? Do we know if growing bodies are more vulnerable to workstation ergonomic injuries than grown adult bodies?
- How significant is the difference in workload between the system administrator of a school thin client system and a standard school PC network? This should be relatively easy to measure over the period of a school year. If it can be shown that there is a significant difference, then some schools might well like to consider transferring to this type of platform in the near future.
- Further WFL research. There is scope for international research on WFL, which is now known internationally as the 'Learning Village'. Since its introduction into Ireland, the 'Learning village' has also been extended into the UK where a number of Beacon schools have taken it on board. It would be very interesting to research the different international experiences with the 'Learning Village' across the globe in order to find out how and to what extent different national education systems and national cultures have affected its implementation and progress to date.

- Finally, more research is needed on the implications of developments in neuroscience for ICT and schools, an area that was briefly touched on in chapter six. This will require a multi-disciplinary approach to research as neuroscientists, educationalists and computer scientists will need to work together to understand the effects of neural plasticity on children's learning and development and what this might mean for the amount and type of ICT exposure they should receive in schools. The concerns of neuroscientists need to be more fully appreciated and understood by IT enthusiasts. At a recent gathering of neuroscientists in 2000, the British neuroscientist, Susan Greenfield (cited in Trench, 2001) warned:

"The internet offers huge benefits....but it could lead to standardised brain connections...If you have in-your-face-information, you don't have the growth of imagination encouraged by a book...There is a real danger that young people will lose their communication skills and get hooked on the thrill of instant images and sound, meaning they won't use their imaginations" (p.52).

The question I posed in chapter six is worth reiterating again on this vexed question of declining literacy standards and its attendant implications. Is IT part of the problem or part of the solution, or perhaps both? If both, then researchers have an obligation to work together in order to figure out how to use it wisely and judiciously to support childrens' education and development.

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